CALAPOOYA II/BIG FIR SPUR PROJECT
UPPER WILLAMETTE RESOURCE AREA
BLM EUGENE DISTRICT
ENVIRONMENTAL ASESSMENT
OR090-EA-09-02

1.0 PURPOSE AND NEED

The Upper Willamette Resource Area of the Eugene District Bureau of Land Management (BLM) proposes to initiate forest management activities on approximately 465 acres located in T.14S., R. 01E., section 35, T. 14S., R. 02W., sections 34 and 35. These activities would include commercial thinning, aquatic habitat restoration, and road management activities (road improvement, construction, and decommissioning). The land use allocations for these sections are Matrix and Riparian Reserve. Stand ages are approximately 45-60 years old.

The need for action in Matrix and Riparian Reserves has been established through the results of field reviews and stand examinations, which indicate that stands would benefit from thinning treatments. Currently, the stands are densely overstocked and are uniform in structure. This results in reduced tree growth and stand vigor. Treatment would increase stand vigor, growth rates, crown differentiation and complexity.

In Riparian Reserves, stand examinations show that stands are deficient in late-successional structural components. Benefits for treating Riparian Reserves would be reestablishment of stands to acquire desired vegetation characteristics, which would help to attain watershed Aquatic Conservation Strategy objectives.

The purposes of the actions in Matrix are to meet the objectives given on page 34 of the Eugene Record of Decision and Resource Management Plan (ROD/RMP). Some listed objectives are to: (1) Produce a sustainable supply of timber and other forest commodities to provide jobs and to contribute to community stability; (2) Provide habitat for a variety of organisms associated with both late-successional and younger forests and maintain valuable structural components, such as down logs and snags. Additional direction for road management is stated on page 98 of the RMP, which directs us to, "manage roads to meet the needs identified under other resource programs."

The purposes of the actions in Riparian Reserves are to enhance or maintain late-successional forest conditions, acquire or maintain characteristics needed to attain Aquatic Conservation Strategy objectives, and to provide habitat for Special Status Species, and other terrestrial species (RMP, pp. 18, 23).

The purpose of the Aquatic Habitat Restoration actions is to aid in the recovery of aquatic species habitat, riparian habitat, and water quality. Some of the important components of aquatic restoration are the control and prevention of road-related sediment runoff and fine sediment production to the stream network; restoration of aquatic habitat complexity, spawning and rearing habitat for resident fish populations; and reestablishing channels at decommissioned road/stream crossings.

1.1 CONFORMANCE

The proposed project is in conformance with the *Eugene District Record of Decision and Resource Management Plan* (June 1995). The proposed project is also in conformance with the Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl and Standards and Guidelines for Management of Habitat for Late-

Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl, April 1994 ("Northwest Forest Plan"); the Record of Decision to Remove the Survey and Manage Mitigation Measure Standards and Guidelines from Bureau of Land Management Resource Management Plans within the Range of the Northern Spotted Owl, July 2007; and the Migratory Bird Treaty Reform Act of 2004. The Calapooya II/Big Fir Spur project file contains additional information compiled by the Interdisciplinary Team (ID Team) to analyze effects and is available for review at the Eugene District Office.

1.2 SCOPING

Scoping information about the Calapooya II/Big Fir Spur Project was first provided in the February 2008 *Eye to the Future*. One comment letter was received.

1.3 ISSUES

The ID Team brought forward additional concerns related to resources that had potential of being affected by the proposed actions. The resource concerns related to the issues, as well as the Critical Elements of the Human Environment are analyzed in Section 3.0: Affected Environment and Environmental Consequences.

Issues identified:

(1) How would thinning and road work affect soils?
- The analysis will assess the extent of soil compaction and displacement that would remain after management activities and the application of mitigation measures.

(2) How do the alternatives impact logging costs?
- The analysis will assess the potential impact on logging costs based on current market values.

2.0 ALTERNATIVES

This section describes alternatives identified by the interdisciplinary team. Please refer to Appendix A for maps of the project proposal.

2.1 ALTERNATIVE 1: NO ACTION

Under this alternative no actions would take place. Commercial thinning, road management, and aquatic habitat restoration actions would not occur within the proposed project area.

2.2 ALTERNATIVE 2: GROUNDBASE AND WINDTHROW REMOVAL

Upland Thinning

This alternative consists of three commercial thinning areas of approximately 360 upland acres. They are delineated as follows:

- Big Fir Spur (T.14S.,R.01E., Section 35) = approximately 100 upland acres.
- Calapooya 34 (T.14S.,R02W., Section 34) = approximately 150 upland acres.
- Calapooya 35 (T.14S.,R.02W., Section 35) = approximately 110 upland acres.

Stands would be thinned from below resulting in 75-100 trees per acre (TPA). Thinning would be designed to increase tree size through time, enhance structural and species diversity, develop windfirm trees, extend the culmination of mean annual increment and capture anticipated mortality. Trees selected for harvest would be the suppressed, intermediate, and co-dominant conifer trees, leaving the larger trees. Cut trees would be western redcedar, Douglas-fir, western hemlock, red alder and bigleaf maple. This prescription would result in a stand with variable spacing (between 15 and 35 feet) between the western redcedar, Douglas-fir, grand fir and hemlock. All Pacific yew would be retained, except where necessary

to accommodate logging systems and for safety. There would be unthinned patches around rock outcrops and shallow soils.

Stands of western hemlock within Big Fir Spur are infected with dwarf mistletoe. Infected trees would be removed to reduce the spread to the remaining western hemlock trees.

Riparian Reserve management
Silvicultural treatments would occur in the outer edges of the Riparian Reserve and would be treated the same as upland. Areas of no harvest, in close proximity to streams and wetlands, would vary between 25 feet and 175 feet. The approximate riparian acres proposed for treatment for each section are as follows:

- Big Fir Spur = 15
- Calapooya 34 = 70
- Calapooya 35 = 25
- Approximate total acres = 110

An average of 180 linear feet per acre of down logs (approximately 3 trees/acre) would be created within treated Riparian Reserves of Calapooya 34 and 35 and an average of 3 snags per acre would be created within treated Riparian Reserves in all harvest areas.

Logging Systems
Thinning would be accomplished with a combination of cable and ground-based yarding systems. Cable yarding would be proposed for approximately 245 acres and ground-based yarding would be proposed for approximately 220 acres (see maps in Appendix A).

Aquatic Habitat Restoration
To enhance aquatic and riparian habitat conditions, approximately 35 trees ranging from 20-32 inches in diameter would be felled from the adjacent riparian area directly into Stream 24. Approximately one-half of a mile of Stream 24 would be treated.

Located on Road 14-2-35.1, road crossings on Streams 7, 12, 14, and 16 would be removed and stream channels and banks restored to a natural condition. This action would include removing existing road fill, tillage of the roadbed, large wood placement, seeding and mulching disturbed area with native plant material, and planting conifers at restored sites. The old road would be barricaded west of Stream 7. Deteriorated stream crossing and relief culverts (Table1 and map in Implementation File) have been identified within the project area as needing replacement. Any stream crossing culvert replacements (non-fish bearing) would be sized to meet the 100 year flow event criteria. Refer to Project Design Features (PDFs) for additional design and implementation criteria.

Roads
Improvement and Construction:
The transportation of timber would occur over approximately 10 miles of existing Bureau of Land Management controlled roads. Of that, approximately 2 miles of road would be improved (please see Table 1) including additional crushed rock surfacing. There would be approximately 1.0-1.5 miles of proposed new temporary road construction and approximately 1.5 miles of new permanent road construction.

Culvert Replacement:
There would be approximately 16 stream culverts, and 12 ditch relief culverts replaced, as well as 4-5 new relief culverts installed.

Road Decommissioning:
Approximately 1.5-2.0 miles of proposed and existing roads would be fully decommissioned at the conclusion of the project (see Table 2). This would consist of blocking access, removal of the culverts, and the tilling of the roadbeds where subgrade conditions allow. Approximately .5 miles of roads would be partially decommissioned at the conclusion of the project. This would consist of construction of waterbars and blocking vehicle access.

Windthrow
In Calapooya 34 there is approximately 10 acres of merchantable windthrown trees. Under this alternative Spur 34G (see maps) would be constructed to facilitate the removal of salvageable trees. After harvest, this area would be planted with western redcedar.

Table 1: Alternative 2

Road Numbers	Permanent Construction Miles	Temporary Construction Miles	Surfacing or Maintenance needs	Maintenance Miles	Approximate Number of Culverts
Spur 35L	0.7 miles		Design 8" rock		
Spur 35P1	0.1 miles		6-8" rock		
Spur 35Q	0.07 miles		6-8" rock		
Spur 34D	0.12 miles		6-8" rock		
Spur 35.1-Ldg. Spur	0.04 miles		8" rock		
*14-2-35.1 3 stream crossings – buried power line in road bed	0.44 miles		8"-10" rock -design		3
Spur 35C		0.25 miles	dirt		
Spur 34A		0.11 miles	dirt		
Spur 34C		0.1 miles	dirt		
Spur 35M		0.14 miles	dirt		
Spur 35N		0.04 miles	dirt		
Spur 34F		0.25 miles	dirt		
Spur 34G		0.13 miles	dirt		
Spur 35P2		0.15 miles	dirt		
14-1E-36B			4-8" lift rock; ditch and cross drains	1.12 miles	1
15-1E-2			0-4"lift rock, grade -ditch	0.28 miles	
14-2-34			Grade and ditch	0.3 miles	
14-2-16			4" lift rock, grade, brush	0.7 miles	3
14-2-16			asphalt	6.0 miles	5
14-2-35			asphalt	0.7miles	
Totals	**1.47**	**1.17**		**9.1**	**12**

2.2 Alternative 3: Cable and No Windthrow Removal

This alternative differs from Alternative 2 in the following areas:

Logging Systems
Thinning would be accomplished with a combination of cable and ground-based yarding systems. Cable yarding would be proposed for approximately 290 acres and ground-based yarding would be proposed for approximately 160 acres (see maps in Appendix A).

Roads
There are slight differences in miles constructed under this alternative. Please see Table 3.

Windthrow
Under this alternative, the 10 acres of windthrow would be withdrawn from the project area. No treatment would occur.

Table 2: Road Decommissioning			
Alternative 2		**Alternative 3**	
Road Number	Miles	Road Number	Miles
Spur 35C	0.25	Spur 35C	0.25 miles
Spur 34A	0.11	Spur 34A	0.11 miles
Spur 34C	0.1	Spur 34C	0.1 miles
Spur 35M	0.14	Spur 35 P2	0.15 miles
Spur 35N	0.04	Spur 34F	0.25 miles
Spur 34F	0.25	14-2-35.1	0.4
14-2-35.1	0.4	14-2-34	0.2
14-2-34	0.2		
Totals	**1.49**		**1.46**

Table 3: Alternative 3					
Road Numbers	Permanent Construction Miles	Temporary Construction Miles	Surfacing or Maintenance needs	Maintenance Miles	Approximate Number of Culverts
14-2-35.1 3 stream crossings – buried power line in road bed	0.44 miles		8" rock - design		3
Spur 35L	0.7 miles		Design 8"-10" rock		
Spur 34D	0.12 miles		6-8" rock		
Spur 35M	0.14 miles		6-8" rock		
Spur 35N	0.04 miles		6-8" rock		
Spur 35.1-Ldg. Spur	0.04 miles		6-8" rock		
Spur 35P1	0.1 miles		6-8" rock		
Spur 35C		0.25 miles	dirt		
Spur 34A		0.11 miles	dirt		
Spur 34C		0.1 miles	dirt		
Spur 35P2		0.15 miles	dirt		
Spur 34F		0.25 miles	dirt		
14-1E-36			4-8" lift rock; ditch and cross drains	1.12 miles	1
15-1E-			0-4"lift rock, grade -ditch	0.28 miles	
14-2-34			0-4"lift rock, grade ditch, add cross drains	0.3 miles	
14-2-16			0-4" lift rock, grade, brush	0.7 miles	3
14-2-16			asphalt	6.0 miles	5
14-2-35			asphalt	0.7miles	
Totals	**1.58**	**0.86**		**9.1**	**12**

2.4 ACS CONSISTENCY

This section summarized how the no action and action alternatives retard, maintain or enhance the attainment of ACS objectives, as outlined in the 1994 NWFP ROD on page B-11.

Alternative 1: No Action

Objective 1*: Maintain and restore the distribution, diversity, and complexity of watershed and landscape-scale features to ensure protection of the aquatic systems to which species, populations, and communities are uniquely adapted.*

Under this alternative, current stream and riparian conditions would be maintained. Small and large wood recruitment to the stream and riparian areas would continue over time. Density induced mortality recruitment of smaller diameter down wood is beginning to slow yet should continue for the next few decades and then generally subside for many decades until tree growth increases and large down logs begin to enter the stream and riparian areas due to natural processes such as disease, competition, and storm related windthrow among dominant and co-dominant trees.

Objective 2*: Maintain and restore spatial and temporal connectivity within and between watersheds. Lateral, longitudinal, and drainage network connections include flood plains, wetlands, up slope Areas, headwater tributaries, and intact refugia. These network connections must provide chemically and physically unobstructed routes to areas critical for fulfilling life history requirements of aquatic and riparian-dependent species.*

Current stream and wetland network connections may change. Riparian, off-channel habitat, refugia, and floodplain connectivity would not be affected. Many stream crossing culverts and relief culverts are undersized, deteriorating, or otherwise at risk of failure in the next decade. The drainage network connections could be blocked by stream crossing fill failures or increased by road ditch erosion caused by potential failures of relief culverts, resulting in the retardance of ACS Objective 2.

Objective 3: *Maintain and restore the physical integrity of the aquatic system, including shorelines, banks, and bottom configurations.*

The physical integrity of the aquatic system would continue to be compromised under the current conditions because stream crossings or relief culverts would not be replaced, removed or added. As a result, deteriorating roads could further retard the attainment of ACS Objective 3 in the short and long-term.

Objective 4: *Maintain and restore water quality necessary to support healthy riparian, aquatic, and wetland ecosystems. Water quality must remain within the range that maintains the biological, physical, and chemical integrity of the system and benefits survival, growth, reproduction, and migration of individuals composing aquatic and riparian communities.*

Based on current conditions, water and streambed qualities would continue to be impacted due to changes in stream substrate composition, and regular inputs of suspended and embedded fine particles from roads. In the long-term, sedimentation could increase and further impact water quality (e.g. reduced oxygen and ability for oxygen diffusion by fish and amphibians) and substrate quality (e.g., embedded fine sediments that reduce the amount and complexity of interstitial spaces and microhabitats requisite for some amphibian and invertebrate species).

Existing shade would remain along streams. Although chronic erosion of the road system may continue, sediment input to streams is not anticipated to measurably impact water temperature in the foreseeable future.

Objective 5: *Maintain and restore the sediment regime under which aquatic ecosystems evolved. Elements of the sediment regime include the timing, volume, rate, and character of sediment input, storage, and transport.*

The natural sediment regime would continue to be affected by current conditions. The timing, volume, rate, and character of sediment input could increase in the future due to direct sediment pulses from deteriorating stream crossing, relief culverts, the lack of road surface aggregate, and unmaintained OHV trails. The roads and undesignated OHV trails that currently deliver sediment would continue to do so and potentially increase sedimentation rates in the future.

Objective 6: *Maintain and restore in-stream flows sufficient to create and sustain riparian, aquatic, and wetland habitats and to retain patterns of sediment, nutrient, and wood routing. The timing, magnitude, duration, and spatial distribution of peak, high, and low flows must be protected.*

In-stream flows and patterns of sediment routing may change due to erosion of existing roads and undesignated OHV trails. The potential failure of relief culverts in the future could extend the stream system, thereby increasing runoff during storm events. Unmaintained OHV trails could also route storm runoff directly into adjacent streams. Existing conditions that affect summer low flows, overall water yield, and peak flow would remain on the current trajectory. There would be no alteration in the factors that influence evapotranspiration and interception. Also see coarse wood recruitment discussion under ACS Objective #8.

Objective 7: *Maintain and restore the timing, variability, and duration of floodplain inundation and water table elevation in meadows and wetlands.*

The existing vegetative cover in the project area would be retained, and no road construction or harvest would occur near floodplains, meadows or wetlands. Since no road improvements or OHV trail management would be implemented, storm runoff may increase in the future and could change the current timing variability and duration of floodplain inundation. Water table elevation would be maintained in project area wetlands.

Objective 8: *Maintain and restore the species composition and structural diversity of plant communities in riparian areas and wetlands to provide adequate summer and winter thermal regulation, nutrient filtering, appropriate rates of surface erosion, bank erosion, and channel migration and to supply amounts and distribution of coarse woody debris sufficient to sustain physical complexity and stability.*

Current rates of surface erosion, bank erosion, and channel migration would continue in the short-term. In the long-term, potential stream crossing and relief culvert failures and OHV stream crossing use could result in channel migration and a degraded condition from associated bank erosion. Untreated Riparian Reserves would continue to recruit smaller diameter coarse woody debris mostly through density-induced mortality or storm related windthrow for the next few decades. However, these areas would not realize the accelerated benefits of larger diameter down wood recruitment process that occur in late-seral stands (e.g, windthrow, disease-induced mortality).

Untreated Riparian Reserves would not experience a reduction in down log recruitment due to thinning and would continue to recruit smaller diameter coarse woody debris mostly through density-induced mortality or storm related windthrow for the next few decades. However, these areas would not realize the accelerated rates of larger diameter down wood recruitment (due to accelerated growth of dominant/codominant trees) that would occur in thinned areas.

Objective 9: *Maintain and restore habitat to support well-distributed populations of native plant, invertebrate and vertebrate riparian-dependent species.*

Aquatic habitat: Species such as aquatic invertebrates, aquatic salamanders, red legged frogs, western pond turtles, and harlequin ducks, which are obligated to aquatic stream habitats, would continue to experience known and potential impacts to water quality as described under ACS objectives 1-7. Specifically, these known and potential effects to water quality could result in a reduction of the invertebrate prey base (e.g., caddisflies) of Harlequin ducks, which would reduce suitability for nesting. Further impacts due to the potential of failing culverts could occur due to increased sedimentation, simplified substrate composition, reduced oxygen diffusion, and potential changes in pH or nutrient composition as described in ACS objective 4.

Terrestrial riparian habitat (Riparian Reserves): Species obligated or associated with riparian terrestrial habitats would not experience any negative short term effects due to soil compaction and changes in canopy closure and microhabitats (as compared to the Action Alternative). No negative short or long term effects to the terrestrial portion of the Riparian Reserves are expected. However, the terrestrial portion of Riparian Reserves would continue to grow and differentiate at a slower rate when compared to the thinned portions of the Riparian Reserve in the Action Alternative. See ACS objective 8 regarding down wood recruitment.

Action Alternatives 2 and 3:

Objective 1*: Maintain and restore the distribution, diversity, and complexity of watershed and landscape-scale features to ensure protection of the aquatic systems to which species, populations, and communities are uniquely adapted.*

Under these alternatives, thinning in the riparian reserves would likely contribute to improving the distribution, diversity and complexity of aquatic ecosystems in and near the project area. Thinning in the riparian reserves would speed the development of late-successional characteristics, such as structural complexity, and larger diameter conifer trees. However, overall instream large woody debris recruitment would be interrupted by thinning harvest due to removal of some trees for wood products (especially small-medium size logs) However, the eventual rate that larger diameter instream large woody debris would be recruited by riparian stands would be accelerated by thinning harvest. See coarse wood recruitment discussion under ACS Objective #8.

No-harvest buffers would protect critical shade vegetation to the stream, reduce sediment transport to streams from upland harvesting activities, and maintain a source of small and large woody debris input in the near term.

Stream Channel Enhancement Actions in Stream 24 would immediately increase in-stream large woody debris thereby directly increasing the amount of habitat complexity and cover (refuge) for fish and other aquatic-dependent species. Long-term benefits would include an increase in the productive capacity of the stream.

Objective 2: *Maintain and restore spatial and temporal connectivity within and between watersheds. Lateral, longitudinal, and drainage network connections include flood plains, wetlands, up slope Areas, headwater tributaries, and intact refugia. These network connections must provide chemically and physically unobstructed routes to areas critical for fulfilling life history requirements of aquatic and riparian-dependent species.*

Drainage network connections would be enhanced by installing properly sized and functioning culverts at identified road-stream crossings on the haul route. However, the time frames for replacing these culverts are

unpredictable. Until these culverts are replaced, effects would be similar to the No Action Alternative.

The decommissioning of a portion of Road 14-2-35.1 and several old spur roads off the 14-2-34 would help restore the spatial and temporal connectivity for aquatic and riparian-dependent species. No new roads would be constructed in riparian reserves that could degrade connectivity for aquatic species. In general, riparian off-channel habitat, refugia, and floodplain habitat would all benefit from these improvements to general network connections.

Over time, the placement of in-stream large wood through aquatic habitat restoration in Stream 24 is expected to develop wood-created pools where the current is slower and water is deeper. These large wood structures would dissipate the streams energy, creating lateral connection with the floodplain and side channels and thus forming essential off-channel habitat aquatic species.

Objective 3: *Maintain and restore the physical integrity of the aquatic system, including shorelines, banks, and bottom configurations.*

Replacing rusted or damaged stream crossing and relief culverts would reduce the risk of fill or road ditch failures. Permanent culverts would be sized to accommodate 100 year storm events, reducing the risk of failure in major flood events. Removing and/or replacing stream crossing culverts would produce a temporary pulse of sediment (see ACS Objective 5) but would unlikely affect the physical integrity of the stream channels. There would be a long-term reduction in the risk of fill failures at those sites. Additional cross drains would also reduce the risk of chronic and catastrophic stream crossing failures, road related landslides, and direct sediment delivery to streams by directing water off the road to stable side slopes. The risk of stream bank failure would be eliminated at sites where existing eroded stream crossings would be removed via road decommissioning on Road 14-2-35.1 and 14-2-34.1. Untreated stream buffers ranging between 75 to 200 feet on either side of stream channels would protect the integrity of stream banks and channels. Stream 9 in Unit C35-3 has a reduced buffer of 25 feet due to special circumstances described in ACS Objective 4. Aquatic habitat restoration actions in Stream 24 would ultimately contribute to enhanced bank stability and an increase in the number of pools.

However, the time frames for replacing these culverts are unpredictable. Until those culverts are replaced the physical integrity of the aquatic system at those sites may continue to be compromised and the effects would be similar to the No Action Alternative.

Objective 4: *Maintain and restore water quality necessary to support healthy riparian, aquatic, and wetland ecosystems. Water quality must remain within the range that maintains the biological, physical, and chemical integrity of the system and benefits survival, growth, reproduction, and migration of individuals composing aquatic and riparian communities.*

Stream crossing work would result in a short term increase in sedimentation, followed by continual long term decreases in sedimentation and increases in overall water quality at those locations. The addition of relief drainage and road surfacing aggregate would reduce road related sediment production in the long-term and have no measurable detrimental impact on existing water quality and downstream fish habitat.

However, the time frames for replacing these stream crossing and relief culverts are unpredictable. Until this work is completed, these crossing and culverts would continue to degrade and potentially impact water quality as outlined under the No Action Alternative.

Some local erosion is likely to occur from yarding operations; however, sediment transport to streams is expected to be minor because most sediment would be trapped within the no-harvest buffers before it reaches the streams. In Unit C35-3, Stream 9 may have increased sediment when logs are placed in it

prior to yarding. This stream is not connected to the rest of stream system by surface flow and therefore changes in turbidity would be localized and contained to that small area. Aquatic habitat restoration actions in Stream 24 would contribute to maintain and reduce stream temperatures in the long-term.

Water temperature would be maintained because the primary shade zone adjacent to all streams would be left intact and thinning in the secondary shade zone would allow for the retention of at least 50% of the canopy in the Calapooya Units 34 and 35. Although a portion of the secondary shade zone south of Stream 4 in Big Fur Spur would be thinned to approximately 40% canopy closure, measurable changes to stream temperature at that location are not anticipated since the primary shade zone would be left intact and the area impacted is a small acreage. That silvicultural treatment area would be underplanted with conifer seedlings after thinning harvest activities.

Overall, long-term sediment inputs and any corresponding short and long term effects to water temperature, nutrients, pH, conductivity, available dissolved oxygen and oxygen diffusion, and substrate composition should be improved by project actions. All of the above benefits would also benefit aquatic-dependent species such as fish and amphibians.

Objective 5: *Maintain and restore the sediment regime under which aquatic ecosystems evolved. Elements of the sediment regime include the timing, volume, rate, and character of sediment input, storage, and transport.*
Short-term sediment increases from activities associated with removing and/or replacing stream crossing culverts, installing cross drains, road renovation, and decommissioning of roads would have a minor effect on total sediment delivery to streams due to mitigation measures, quantities, and proximity to streams. Long-term sediment reduction would correlate to the number of road miles upgraded and number of stream crossings removed during the project. Upgrades and reduction of road stream crossings to the existing transportation system would result in less sediment production within the watershed. Impacts to water quality from the use of undesignated OHV trails would continue and possibly increase due to the inability to enforce closures under current budgets.

However, the time frames for replacing some of these stream crossings and culverts are unpredictable. Until those are replaced the effects would be similar to the No Action Alternative.

Aquatic habitat restoration actions in Stream 24 is expected to result in the accumulation of additional small and large wood, thereby creating small dams with an upstream area that allows for the deposition and storage of essential substrates.

Objective 6: *Maintain and restore in-stream flows sufficient to create and sustain riparian, aquatic, and wetland habitats and to retain patterns of sediment, nutrient, and wood routing. The timing, magnitude, duration, and spatial distribution of peak, high, and low flows must be protected.*

The Calapooya harvest areas are at elevations where predominately rain events occur. Big Fur Spur is located in the transient snow zone. Protective no-harvest buffers are prescribed for all streams and wetlands and road improvement or decommissioning would improve drainage characteristics adjacent to roads, therefore proposed actions are not expected to impact the timing and magnitude of peak flows. Undesignated OHV trails will continue to route runoff to adjacent streams.

Objective 7: *Maintain and restore the timing, variability, and duration of floodplain inundation and water table elevation in meadows and wetlands.*

Protective buffers adjacent to all streams, springs, and wetlands would protect surface and subsurface hydrology. Improved road drainage measures would minimize related runoff to nearby streams and

wetlands so that floodplain inundation and groundwater levels would be protected. However, the time frames for replacing some of these stream crossings and culverts are unpredictable. Until those are replaced, the effects would be similar to the No Action Alternative.

In the windthrow area of Calapooya 34, it is uncertain that surface water flow and ground water movement would be maintained. This impact would be mitigated by using specific logging equipment outlined in the PDFs.

Over time, the placement of instream large wood is expected to create greater connection with the floodplain and off-channel habitat. Undesignated OHV trails will continue to impact meadows adjacent to the harvest areas.

Objective 8: *Maintain and restore the species composition and structural diversity of plant communities in riparian areas and wetlands to provide adequate summer and winter thermal regulation, nutrient filtering, appropriate rates of surface erosion, bank erosion, and channel migration and to supply amounts and distribution of coarse woody debris sufficient to sustain physical complexity and stability.*

No timber harvest would occur within 75 to 175 feet of the streams (depending on the stream). [The one exception is Stream 9 in Harvest Unit C35-3 which will have a no harvest buffer of 25 feet. This stream will be protected with the placement of large wood to provide for cable logging corridors.] Therefore, streamside bank erosion, surface erosion and channel migration would not be impacted by harvesting activities. Road construction, renovation, and decommissioning would be designed and conducted to mitigate chronic sediment inputs into stream channels. However, the time frames for replacing some of these stream crossings and culverts are unpredictable. Until those are replaced, the effects would be similar to the No Action Alternative.

Undesignated OHV trails will continue to erode, possibly resulting in bank erosion at trail stream crossings and gullying of the tread running surface.

When compared to unthinned portions of Riparian Reserves, thinning harvest causes a change in the size, amount, and rate of coarse woody debris recruitment during the first several decades after treatment.

Compared to unthinned areas, thinned Riparian Reserve areas would recruit much smaller amounts and sizes of coarse wood over the next few decades through natural processes typically seen in mid-seral conifer stands (e.g.,density-induced mortality). Existing large instream wood, and moderately decayed large snags and terrestrial down wood (decay class 2-3, greater than at least 16-20 inch diameter) that are required by many wildlife species, would all continue to decay and decline in amount and function due to natural stand processes and would generally not be replaced by natural stand processes for many decades. This could result in a shortage of some instream coarse wood and (especially) terrestrial down logs and snags, for many decades due to:

1) Natural stand processes where there is a reduction in coarse wood recruitment between the end of the high density stem-exclusion phase of mid-seral stands and the beginning of late-seral age stands; and

2) Thinning that removes trees that would otherwise be naturally recruited by the stand into down logs (through density-induced mortality due to high stem densities).

Some of the potential deficiencies in large instream wood in Stream 24, would be mitigated by Stream Channel Enhancement Actions discussed under ACS Objective #1.

However compared to unthinned areas, thinned Riparian Reserve areas would ultimately recruit larger sizes of coarse woody debris sooner. This would be due to thinned stands experiencing accelerated

growth of dominant/codominant trees, and in turn, an accelerated rate when these larger trees would be recruited by the stand into larger coarse wood (through natural processes that occur in later seral stands).

Objective 9: *Maintain and restore habitat to support well-distributed populations of native plant, invertebrate and vertebrate riparian-dependent species.*

Terrestrial riparian habitat (Riparian Reserves): Within treated portions of Riparian Reserves, species obligated or associated with riparian terrestrial habitats would experience some short term effects due to soil compaction and changes in canopy closure and microhabitats. However, no negative long term effects to these treated areas are expected and they would generally recover in 5-15 years as canopy closures increase. Untreated terrestrial portions of Riparian Reserves would not experience the above short term negative effects but would also continue to grow and differentiate at a slower rate when compared to the thinned portions of the Riparian Reserve in the Action Alternative. See ACS objective 8 regarding down wood recruitment rates in thinned and unthinned portions of Riparian Reserves.

Aquatic habitat: Species such as aquatic invertebrates, aquatic salamanders, red legged frogs, western pond turtles, and harlequin ducks that are highly obligated to aquatic stream habitats would generally continue to experience some of the known and potential negative impacts to water quality as described under ACS objectives 1-7 that are due to natural conditions (e.g., low gradient streams) However, these species would benefit from all of the known/potential benefits described under ACS Objectives 1-8 due to amelioration of human caused influences such as roads and deteriorating culverts. Short and long term impacts would be due to increased sedimentation, decreased substrate composition, reduced available oxygen, and potential changes in pH, or nutrient composition. Harlequin ducks would experience benefits to their aquatic invertebrate prey (e.g., caddisflies) due to benefits to water quality.
Species such as western pond turtles, harlequin ducks, and red legged frogs would realize immediate and long term benefits due to aquatic habitat restoration activities in Stream 24.

2.5 DESIGN FEATURES FOR THE ACTION ALTERNATIVE

Harvest

1) Retain yew and madrone, except where necessary to accommodate safety and logging systems.
2) Apply seasonal restrictions or suspension of all harvest and road activities that would occur within 1/4 mile of known nesting peregrine falcons, bald eagles, spotted owls, great grey owls, accipiter hawks, and other owls, hawks, or raptors if they are located at any time during project activities.
3) Spotted Owls: Consistent with ESA consultation with the USFWS apply the following reasonable and prudent measures to minimize disruption/disturbance to spotted owls and their progeny:
   - Quarry activities: If necessary to avoid disruption during the nesting season of Northern Spotted Owls blasting and/or rock crushing at quarries would not occur between March 1st and July 15th/September 30th. Specific restrictive periods vary by quarry and must first be approved by the Area Wildlife Biologist.
4) Bald Eagles: Consistent with objectives of the Bald and Golden Eagle Protection Act, apply the following restrictions to minimize disruption/disturbance to bald eagle midwinter roosting behavior:
   - Quarry activities in/near Calapooya Units only: If necessary to avoid disruption/disturbance of midwinter roosting, blasting and/or rock crushing at quarries would not occur between November 15 and March15th. Specific restrictive periods vary by quarry and must first be approved by the Area Wildlife Biologist.
5) Consistent with objectives of the Bald and Golden Eagle Protection Act, apply the following restrictions to minimize disruption/disturbance to bald eagle midwinter roosting behavior:
   - Harvest & Related Actions: In Calapooya harvest areas C34-6 & C34-2 in Calapooya 34: no harvest actions (including felling, yarding, decking, hauling, and road work) shall occur between November 15 to March 15. This restriction is not subject to being waived due to survey results.

6) Snag, Down Log, and Large Remnant Tree Retention: Retain snags and down logs in decay classes 3, 4, 5 on site. Large remnant trees (≥ 30 inch dbh) would be retained, undamaged when possible, and would not be cut except those in road construction, landings, and yarding corridors, and those posing a safety hazards.

7) Placement of Yarding Corridors to Protect Snags, Down Logs, and Large Remnant Trees: Place cable corridors on the landscape to avoid felling large trees (≥ 30 inch dbh) and snags, and to minimize disturbance to down logs. Existing down logs, snags, existing rootwads and large diameter stumps would be retained on site. Down logs and root wads that present a hazard to logging operations or that are needed to close roads may be relocated within the project area.

- Snag and Down Log Creation: Within treated portions of Riparian Reserves, create an average of 120 linear feet/acre of down wood (3 trees per acre) in Calapooya units only and 3 snags/acre in all harvest areas (see implementation notes within the project's analysis file for specific treatment specifications).

8) Down Log Retention Within Salvage Blowdown Area C34-2 (in Calapooya 34):
Of trees already blown down, 6 trees would be retained on site for down log habitat. All such trees would be ≥ 18 diameter at the large end and ≥ 40 feet in length if cut for operational reasons (*longer log lengths are preferred, but trees may be cut to lengths ≥ 40 feet to accommodate other operational needs).*

9) Limit log lengths to 40' in length where necessary to minimize damage to residual trees, snags and coarse woody debris during yarding.

10) Restrict cutting and yarding during sap flow (April 1st to June 15th).

11) Utilize, when operationally feasible, falling and yarding techniques for the protection of retention trees, existing coarse woody debris, snags, and reserve areas.

12) Require one-end suspension of logs while skidding and cable yarding. Intermediate supports may be required to accomplish this objective.

13) Approve mechanical harvester system when:

- Capable of directionally falling trees
- Traveling on the cushion of slash created by the harvesting process
- Where slopes are less than 40%
- Soil moistures are low (typically July 1st – Oct 15)

14) Apply the following requirements to ground base yarding areas:

- Require felling of trees to lead of the skid trails and maximize winching distances.
- Placement of skid trails would be avoided within 75' of posted stream boundary.
- All skidding equipment would remain on the designated skid trails.
- Average distance between skid trails would be 150 feet or greater where feasible.
- Use existing skid trails, where possible.
- Avoid placing skid trails on rocky soils.
- Preplan and designate skid trails to occupy less than 10% of the Harvest Area.
- Restrict ground-based yarding to seasonally dry period when soil moisture content provides the most resistance to compaction. This is usually July 1st through October 15th.

15) Till, where feasible, compacted skid trails, with an excavator to a depth of 18 inches, when soil moisture is appropriate. Minimize damage to residual tree roots adjacent to trails.

- To reduce erosion and restore soil productivity, pull slash, logging debris and brush from the adjacent forest floor onto the skid trails.

16) If tillage cannot be accomplished the same operating season, all skid trails and temporary native surface roads would be left in an erosion resistant condition and blocked prior to the onset of wet weather. This would include construction of drainage dips, water bars, lead off ditches, and barriers (rootwads or brush piles) to prevent vehicle access until final blockage and/or tilling.

17) Within salvage blowdown area C34-2 (in Calapooya Section 34) and on the Cumly soils within Big Fir Spur, a tracked harvester would be used to reduce ground pressure. Equipment would walk on

slash created from processing to further reduce ground pressure.

18) Within Optional Harvest Area C34-1 in Calapooya 34: wood would be mechanically cut and moved for cable yarding without impacting the buffer on Stream 3.

19) Keep a Spill Contamination Kit (SCK) on-site during any operation within the project area; prior to starting work each day, all machinery would be checked for leaks and necessary repairs would be made.

20) Removal, notification, transport and disposal of any diesel, hydraulic fluid, or other petroleum product released into soil and/or water would be accomplished in accordance with U.S. EPA and DEQ Laws, and regulations.

21) Logs shall be placed in Stream Channel 9 in Harvest Area C35-3 prior to yarding across the stream to mitigate damage to streambanks and channel integrity. Upon completion of yarding activity, logs would be dispersed within the channel and riparian area. Disturbed areas shall be mulched and planted with native grass. This harvest area would be restricted to a single season operation, and the disturbed area would be restored within the same season.

22) Cover and burn landing piles along permanent roads.

23) Pile, cover and burn slash, less than 6" in diameter and greater than 3' in length, within 25 feet of either side of the permanent roads within harvest areas.

24) Scatter landing piles, along temporary roads, on top of the road surface to remove the fuel concentrations and slow erosion. Resulting fuel bed would not be deep and continuous. Piles along temporary roads not scattered on the road surface would be covered and burned.

25) Cover all piles to be burned with plastic.

26) Prevent the spread of noxious weeds from other locations, by washing logging, road construction, and tilling equipment prior to entry on BLM lands.

Roads

27) Limit use of native surfaced roads to the dry season (generally between July 1st and October 15th). Waterbars, drain dips, and/or lead-off ditches may be required to create an erosion resistant condition on roads during seasonal closures. Access to such roads shall be blocked during closures.

28) Pull back stream banks at removed crossings to an angle of natural repose.

29) Require the following along perennial streams:

- Stream flow would be routed around the construction activity as much as possible (e.g. temporary flow diversion structure).
- Sediment containment structure placed across the channel below the work section (i.e. straw bales) as needed.
- Work site would be pumped free of standing water
- Fish and other aquatic species would be removed from the project area and block nets placed above and below the worksite.
- After installation, the disturbed section would be planted with native seed and mulched with native straw or wood mulch before the first rains

30) Apply Oregon Department of Fish and Wildlife (ODFW) in-water guidelines to all in stream activities. Work would be done between the dates of July 1st through October 15th.

31) Implement the following combination of methods during heavy and/or prolonged rainfall or freezing and thawing periods to minimize sedimentation from the gravel surfaced roads into stream channels:

- keep ditch line, cross drains, and leadoff ditches clean and free to flow, while minimizing disturbance to existing ditch line vegetation.
- Sediment traps may be installed in ditch lines lacking vegetation and having the potential to deliver sediment to streams.
- Prior to and during haul operation, rock surfacing and road maintenance would be assessed throughout the project area and haul route.

- If erosion and road degradation occur after freeze and thaw periods, log haul operations may be discontinued.

Road Decommissioning

32) On perennial streams sediment containment structure would be placed across the channel below the work section.

33) Fill or waste material would be located outside of the riparian area and positioned in a location that would avoid direct or indirect sediment discharges to streams or wetlands.

34) Depending on site conditions, road drainage features (drain dips or waterbars) may be constructed on either side of restored stream channels to reduce road sediment delivery.

35) Restored stream banks would be vegetated with native plants, mulched with native straw or wood mulch, and planted with western redcedar where appropriate.

36) Where road subgrade conditions warrant, compacted road surface would be tilled with an excavator when soil moisture is appropriate (generally between July 1 and October 15). If tillage is not possible then waterbars and lead-off ditches would be constructed to reduce sedimentation to streams and wetlands. Logging debris and brush would be placed along roadbed to reduce erosion and block access.

37) Earthen barricades with brush and slash additions would be constructed to block vehicle access.

38) Recycle culverts removed from stream crossings or relief drainage sites.

Aquatic Habitat Restoration (Instream LWD placement – Stream 24):

39) Tree felling would occur between June 1 – September 30 (Calapooya II) to accommodate Oregon Department of Fish and Wildlife (ODFW) guidelines for in-water work period, and seasonal restrictions to avoid disturbance to nesting birds. The portion of the seasonal restrictions due solely to wildlife (July 15 – Aug 15) may be waived or reduced by the Area wildlife biologist based on relevant survey information regarding occupation or nesting activity of spotted owls and other raptors.

3.0 AFFECTED ENVIRONMENT AND ENVIRONMENTAL EFFECTS

3.1 ISSUE 1: HOW WOULD THINNING AND ROAD WORK AFFECT SOILS?

3.1.1 Soils: Affected Environment

Calapooya 34 and 35

Past compaction and displacement of surface soils in the Calapooya sections have reduced soil functions such as nutrient cycling and biomass production in localized areas. Residual compaction is largely confined to old travel ways rather than throughout the stand. Excavation and rock additions are not uncommon where ground based systems were used on variable slopes in excess of 45%. Although difficult to quantify, the spatial extent of severe to moderate compaction in the Calapooya unit(s) is estimated to be below the District's RMP standard of 2% or less (p. 37).

Nekia soils are the dominant soil series in both sections, occurring on slopes less than 30%, except in section 34 where the Nekia series occurs on moderately steep slopes up to 50%. These soils are moderately deep (20 to 40") with silty loam topsoil and clay subsoil. Nutrient status, resiliency, and plant available water are high. Nekia soils have high clay content and low coarse content in the top 20 inches which creates moderately slow permeability and makes these sites very prone to compaction.

Blachly soils are the most prevalent series in section 35. Slopes are moderately steep to steep (30 to 65%)

on north and east aspects. The topsoil is clay loam, the subsoil silty clay and clay. The soils are deep and clay rich with minimal coarse content in the soil profile. These characteristics produce moderately slow internal drainage (permeability) which makes Blachly soils prone to compaction.

Also present in these units are Kinney soils. Typically these soils are deep and well drained. The surface soil is cobbly loam, the subsoil cobbly clay loam with from 25 to 45% coarse content. Nutrient status, plant available water, and resiliency are all high. Kinney soils have a risk of surface erosion and displacement due to the coarse soil texture.

Ritner soils are moderately deep and well drained. Ritner soils are of limited extent in the proposed harvest area. Typically the topsoil is cobbly silty clay loam, with very cobbly silty clay loam and silty clay subsoil. Nutrient status and resiliency are intermediate. The upper 20 inches have moderate to low water holding capacity due to a high amount of coarse fragments, heavy textures, and low organic matter content.

Hazelair soils are moderately deep and somewhat poorly drained. The extent of Hazelair soils in the project area is limited to the windthrow area in Calapooya 34. These sites have intermediate nutrient status, resiliency, and plant available water. The A and B horizons are silty clay loam, with clay subsoil. Permeability is very slow due to very high clay content, up to 70% in the subsoil, and weathered siltstone at about 34". Hazelair soils exhibit high chroma mottles and generally reduced soil colors within 15 inches of the soil surface which reflects the seasonal high water table.

Hazelair soils are classified as "Fragile Suitable Restricted" under the Timber Production Capability Classification (TPCC) system due to the seasonal high water table (RMP, p. 172). The Hazelair series does not always meet the specific criteria to be called "hydric" (a wetland), but water may be at or near the surface for sufficient periods of time. This sort of moisture regime may limit overall conifer productivity. In many cases, conifer will occupy elevated micro-sites where soils are somewhat deeper and better drained. Trees grow well until they are about 35 years old, at which time the root system becomes restricted by the clay and high water table.

The timing of seasonal soil moisture can vary considerably for Hazelair soils depending on specific topography and ground water flow patterns. Soils are usually moist, but may be dry between the depths of 4 to 12 inches for 60 consecutive days. Based on soil moisture samples taken in July and August of 2008, it is reasonable to assume that resident soils in this topographic position may not be dry for greater than 30 days in the summer months given the ground water interaction. The soil moisture samples taken in July ranged from 30 to 39%, with an average less than 35%. Another set of four taken on August still had moistures in excess of 25%.

Big Fir Spur

The Big Fir harvest area shows evidence of reduced soil quality and productivity from past harvest and roading activities. There is residual compaction throughout the stand. Some old skid roads have interrupted or altered ground water flow patterns. Current residual compaction is estimated to occupy 3 or 4 percent of the proposed unit, or three to five acres of the 110 proposed for treatment this entry, which exceeds the RMPs growth –loss effect of 2% (RMP, p. 37). It is reasonable to assume that over time, compaction has not been reduced because winter temperatures are too mild for routine freezing and thawing which can lessen soil compaction in colder climates.

Cumley soils are the dominant soil series in this part of the project area. This soil series commonly occurs in depressional topography adjacent to streams or wetlands, or on old landslide topography that has benches and short steep slopes. The soils are deep (40 to 60"+), with high nutrient status and plant available water. Topsoil is silty clay loam with silty clay and clay subsoil. Permeability is moderately

slow due to the high clay content with minimal coarse fragments. Cumley soils have a seasonal high water table at 2 to 3 feet as evidenced by mottles at depth.

Peavine soils are moderately deep (average 35 to 40") and well drained, with silty clay loam topsoil over silty clay and clay subsoil. These soils have high nutrient status and plant available water in the upper 20 inches. Peavine soils occur in the northeast corner of the unit. Topograhy is less than 35% on the knolls, with moderately steep side slopes on the south and north aspects.

Honeygrove soils are deep (average 50 to 60") and well drained, with silty clay loam topsoil over clay subsoil. These soils have high nutrient status. The low amount of coarse fragments, high clay content, and high organic matter content all combine to produce a high water holding capacity. This soil series typically occurs on broad stable ridges with slopes less than 25%.

Kilchis soils are shallow and skeletal. Total depth is typically less than 10 inches, with greater than 55% coarse content, gravels and cobbles. An area of Kilchis soils occurs on south and west aspects just below the ridge in the center of the unit. Half of the area is occupied by small diameter Douglas-fir. The small size is probably due to low site productivity and low available water of the soils. The western part of the area is occupied by brush with only widely spaced conifers.

Kilchis is classified as low resiliency. Sites with low resiliency typically require multiple protective measures and offer minimal opportunities for manipulating the surface vegetation without impairing inherent properties and processes, and/or accelerating the frequency and magnitude of erosional events. These soils are poorly suited to the production of Douglas-fir. On the basis of a 100-year site curve, the mean site index for Douglas-fir is 110.

3.1.2 Soils: Environmental Effects

No Action

No additional soil compaction or displacement would occur as a result of harvest or road building. The legacy compaction and loss of topsoil associated with past harvest activities will persist for the long term, as will the associated productivity losses. Time to recover soil function and productivity will vary from decades to centuries, depending on depth of excavation.

Effects Common to both Action Alternatives

Calapooya 34 and 35:
The bulk of the thinning is proposed on sites with intermediate or high resiliency soils. These soil types can sustain substantial manipulation and still maintain nutrient capital, inherent physical and chemical capabilities, hydrologic function and natural rates of erosion. Project design features would minimize the potential for accelerated erosion throughout all phases of operation. The only exception to this is the 10 acre wind throw area on hydric soils between streams 20 and 23 that would be harvested in Alternative 2. No harvest or road building is proposed in areas identified as having a high potential for slope failure.

Approximately 210 acres, or 60 % of this unit would be yarded with cable systems. Direct effects of cable yarding would be displacement of surface soil and organic matter, and discontinuous localized compaction within yarding corridors. These effects tend to be confined to a narrow strip less than four feet wide. Compaction would be deeper and more continuous for areas harvested in the winter when soils are wet. Compaction reduces porosity which is an essential component of site productivity. It is instrumental for water infiltration, water storage, and gas exchange. Soils with good porosity create favorable conditions for root growth, water movement, nutrient uptake by roots, and mychorrizal growth

(Amaranthus and others, 1996).

Design features would limit the spatial extent of these impacts and the potential for prolonged erosion. After operations, bare soil exposure, and compaction in corridors and associated landings would occupy about three percent of the cabled portions, or 6 acres in Calapooya 34 and 35. Full vegetative recovery within corridors is expected within five years for the highly resilient soils. Vegetative cover on the coarse textured, intermediate resiliency soils is expected in less than 10 years.

In general, ground based yarding is planned where suitable soils occur and slopes are less than 35 percent, approximately 140 acres, or 40% of the Calapooya 2 unit. These logging systems have the potential for more severe compaction than cable systems because trails are wider and compaction extends deeper. Organic matter and topsoil are bladed off/severely displaced which reduces long term soil productivity within the skid trails. A suite of Best Management Practices and other design features are employed to reduce the spatial extent and duration of the effects. Severity of effects would vary depending on the type of ground based system employed by the operator, and the number of trips on any given trail segment.

Studies indicate that after six trips, all soil textures will become compacted to the point that functions such as water storage, nutrient and biomass production are impaired (Amaranthus and others, 1997). The residual effects of un-treated historic compaction can persist for 50 years or longer. Nekia silty clay loam, the primary soil type where ground based systems are planned, has clay contents between 40 and 50%. Even with delayed felling of trees, there is a reasonable possibility that soil moisture may not reach the required 25% on northerly aspects, excluding the use of all yarding systems besides cable. If operations are allowed to proceed at moisture contents above the threshold, soils would be less resistant to compaction. Correspondingly, deeper more severe compaction would be expected.

After harvest, about ten percent of the ground based portions, or 14 acres, would be occupied by skid trails and/or landings. All skid trails used in this entry that exhibit compaction would be tilled. Tillage with an excavator would restore infiltration and hasten vegetative recovery. Utilizing old routes reduces new adverse impacts and provides the opportunity to treat residual effects in some areas. Residual compaction in certain areas would not be treated, and effects may persist into the next rotation.

Big Fir Spur:
The combined long term effects to soils from road building and repeated harvest entries with ground based equipment on sensitive soils at Big Fir Spur would result in reduced soil function and impaired long term soil productivity on as much as 20 percent of the total treated acreage. Residual impacts, combined with compaction and loss of topsoil incurred on the Cumley soil that cannot be effectively ameliorated, may reduce the timber site class and merchantable volume at time of final harvest.

Alternative 2: Groundbase and Windthrow Removal

Calapooya 34 and 35:
Alternative 2 includes the harvest of 10 acres of wind throw with ground based equipment. On Hazelair soils the RMP recommended practice is to avoid ground based logging systems when soils are wet, due to properties discussed in the soils affected environment section and that they readily compact due to the high clay content.

Under this alternative, in addition to harvesting the down trees, some live standing green trees that are damaged, leaning, or posing a safety hazard will need to be cut and removed as well. Transpiration rates would be reduced, which could increase the time soils are wet, and shorten the operating season even more.

Project mitigations such using a processor with low PSI tires, would produce less compaction as compared to a feller buncher, largely because of the processor's ability to travel on a cushion of created slash. However, the lower PSI machine would not compensate for the impacts expected due to soil moistures.

The lack of directional felling would likely increase the areal extent impacted by yarding. Soil displacement is expected because logs have to be positioned. Yarding logs through wet areas can disrupt natural drainage, both surface water flow and/or groundwater movement. Compacted skid trails can also block natural drainage patterns.

The aquic moisture regime of Hazelair soils precludes the mitigation of compaction through tilling/ripping because the soils are seldom dry, and compaction can extend deeper than the effective depth of standard tillage implements. A wide range of aggregate sizes is essential for water movement, and air and gas exchange in soils. Un-ameliorated compaction would alter the timing of water infiltration and storage on these acres.

The existing spur road would be widened and upgraded, and rerouted away to a well drained upland position. Productivity would be lost on a portion of an acre within the Riparian Reserve. The existing route has some added rock and residual compaction, therefore the soil productivity loss is not associated with this action.

Construction of approximately 1.5 miles of new road would be surfaced with crushed rock and added to the District's permanent road system. Existing roads would be renovated and remain on the road system indefinitely, as well. Soil productivity would be lost on approximately 4.5 acres of forested land.

Construction of temporary native surface road and associated landings would result in the loss of topsoil and compaction on 2.5 acres of productive forested land. In general, these temporary roads are planned on gradual grades and tillable soils. Tillage would improve infiltration and mitigate the potential for prolonged erosion. Root growth in the loosened soil areas would be better distributed and more vigorous, resulting in an accelerated improvement of soil structure and recovery back to a forested condition as compared to leaving untreated compacted surfaces. However, soil function and long-term productivity would still be impaired for 50 years or longer largely due to the loss of topsoil.

Construction of temporary rocked road is expected to result in greater direct and indirect impacts to soil function than the native surface temporary roads. Rock removal would cause deeper excavation than what is needed for construction. Soil aggregates and texture would be altered when rock removal is incomplete affecting infiltration and water storage characteristics.

Big Fir Spur:
Approximately 40 acres or 36 % of the unit would be harvested with cable systems. Effects would be comparable to those described for Calapooya 34 and 35. After operations, bare soil exposure, soil displacement, and compaction in corridors and associated landings would occupy about 3% of the cabled portions, or 1.2 acres in Big Fir. Vegetative regrowth within corridors is expected within 5 years for resilient soils.

Approximately 70 acres or 36% of the unit would be harvested with ground-based systems.
Soil displacement and compaction in skid trails and associated landings would occupy about 10% of the ground based portions, or 7 acres in Big Fir, after harvest operations are completed.

In general, effects would be comparable to those described for Calapooya 34 and 35, except for the Cumley soils. Due to a seasonal high water table, the soils may not dry out enough to provide resistance

to compaction from ground based equipment. Small inclusions may remain wet into the growing season.

Cumley soils are considered "Restricted" under the Timber Production Capability Classification System (RMP p.171). The high water table and other characteristics combine to elevate the risk of compaction and associated productivity losses.

Project mitigations such as the low ground pressure harvester/processor would minimize ground pressures exerted onto the soils. The ability to travel on the cushion of slash and limbs created by the harvest process would also reduce the risk of compaction. However, tillage may not be effective on Cumley soils. Soils are seldom dry, and compaction often extends beyond the depth of standard tillage implements. When soil moisture is near 30%, lateral shatter is not achieved and only large clods are produced, rather than a mix of aggregate sizes.

Alternative 3: Cable and No Windthrow Removal

Calapooya 34 and 35:
The 10 acres of windthrow in section 34 would not be harvested at this time. None of the soil quality impairments described in Alternative 2 would be incurred, since no ground base machinery would be operating on the sensitive Hazelair soils.

Effects to soils from road construction and maintenance activities would be comparable to Alternative 2.

Big Fir Spur:
Wherever topography allows, about 40 acres, the Cumley sites, would be harvested with cable systems rather than ground based machinery. In general, effects would be similar to those described for other soil types in Alternative 2.

Severity and depth of compaction within corridors would both increase during winter operations when soils are wet. Clay textures are very strong and resistant when dry, but weak and prone to deformation when wet. More than average gouging is anticipated where slopes are less than 20%. Where possible, convex slope shapes would be avoided when placing corridors since these topographic positions would be most prone to gouging and chronic erosion.

3.2 ISSUE 2: HOW DO THE ALTERNATIVES IMPACT LOGGING COSTS?

3.2.1 Logging Costs: Methodology

Each of the action alternatives proposes a combination of ground-based yarding and cable yarding. Logging systems were based on factors such as slope percent, soil suitability, stream location, access, timing and operational feasibility. Each factor contributed to the amount of acreage per alternative of cable and ground-base (see Table 4).

Table 4: Types of Logging Systems by Alternative

Logging System	Acres by Alternative		
Alternative	1	2	3
Ground-base	0	214	156
Cable	0	248	296

In all action alternatives, stands would be thinned to 75-100 trees per acre. Stand exam data were processed through Land Management System (LMS) software to gain average harvest volumes per area

(*i. e.* Calapooya 34 and 35, and Big Fir Spur) with this prescription. Average volumes were 16.3 thousand board feet per acre (MBF/Acre) for Calapooya 34 and 35, and 17.4 MBF/Acre for Big Fir Spur. The currently volatile timber market has made timber prices difficult to project. For instance, between January and June of 2008, prices have fluctuated $200 per MBF for Douglas-fir logs on the Eugene District BLM. Values for species and products frequently change following economic trends in regional and global markets.

Costs to logging, however, remain somewhat constant due to relatively consistent logging systems and machinery. Logging costs were analyzed with the *Northwest Logging Costs* and *Helolog Cost 80* computer programs with inputs derived from stand exam data, GIS acre estimates for cable and ground-based systems, average historical Eugene District transportation costs, and current district pond values (as of 7/31/08). Through this process, Calapooya 34 and 35 were estimated to have an average cost of $165 per MBF for both alternatives. Big Fir Spur was estimated to have an average cost of $156 per MBF for Alternative 2 and $173 per MBF for Alternative 3.

To estimate road construction, maintenance and renovation costs per alternative, the current BLM road appraisal system was used.

3.2.2 Logging Costs: Results

No Action Alternative:
There would be no logging or road cost accrued as the project would not be harvested.

Alternatives 2 and 3:
The estimated costs are as follows:

Table 5: Cost Comparison by Alternative

	ALTERNATIVE 1	ALTERNATIVE 2	ALTERNATIVE 3
Logging Costs	0	$1,262,932	$1,278,414
Road Construction and Maintenance Costs	0	$286,000	$300,000
Culvert Costs	0	$118,500	$118,500
Overall Road Costs	0	$411,500	$418,500
Total Costs	**0**	**$1,674,432**	**$1,696,914**

The results show a difference of $22,482 between Alternatives 2 and 3. Alternative 3 costs are higher due to: (1) higher costs for cable logging versus ground-based logging; (2) The rocking of Spurs M and N in Alternative 3 versus leaving them native surfaced in Alternative 2.

3.3 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES COMMON TO ALL ACTION ALTERNATIVES

3.3.1 Vegetation: Affected Environment

The forests in this project are 45-60 year old stands that regenerated naturally after clearcut harvest, and salvage logging following large human caused fires. The stands consist primarily of Douglas-fir, western hemlock, western redcedar, bigleaf maple, Pacific yew, madrone, chinquapin and red alder. Stand understories consist of salal, bigleaf maple, vine maple, dwarf Oregon grape, sword fern, cascara buckthorn, and oceanspray.

Stand density is approximately 175-190 trees per acre. The stands are currently in a stem exclusion phase, and the high overstory density is suppressing the growth of smaller trees and understory vegetation. Past harvest practices removed the large Douglas-fir trees; thus, there are extensive patches of western redcedar, alder and big leaf maple with few Douglas-fir trees. The alder and big leaf maple trees are beginning to reach biological maturity.

Within Calapooya 34, there is approximately 10 acres of Douglas-fir and western redcedar that blew down during recent winter storms.

Stand conditions in the outer portion of the Riparian Reserves are largely similar to the uplands. The immediate riparian zone of many of the streams in the project area are dominated by deciduous trees, mostly red alder, bigleaf maple and scattered cottonwood trees. The bryophyte community is high in biomass and low in species richness. Virtually all substrates are colonized, with common terrestrial species dominating. The lichen community is poorly developed, dominated by common mid-seral species; biomass and species richness is low.

Big Fur Spur has a high density of western hemlock, occupying approximately 50% of the stand, the rest of the stand is Douglas-fir. Much of the hemlock is infected with hemlock dwarf mistletoe (*Arceuthobium tsugense* subsp.*tsugense*), a parasitic, seed-bearing plant with the specific host of living western hemlock.

Special Status Plant Species:
Vascular and non-vascular plant surveys were done in 2008. The only Special Status Species found within the project area is Tall Bugbane (*Cimicifuga elata*). Tall Bugbane is currently a sensitive species under the BLM special status species program, a candidate species under the state program and the Oregon Natural Heritage Information Center (ORNHIC) List 1.

Outside of the project area, but on nearby BLM lands, exists populations Kincaid's lupine (*Lupinus sulphueus ssp. Kincaidii)* a federally threatened species.

Weeds:
In Big fur Spur, a survey done in 1998 showed that the unit was relatively weed free with small infestations of scotch broom and blackberries along the road. No false brome was seen. Now in 2008, false brome is dense along the roads and spreading into the forest. The false brome was most likely introduced by road repair, road maintenance equipment or vehicle traffic.

In Calapooya 34 and 35, Timber Road (also known as Blagen Mill Road) is a major paved road through the project area. This paved road is a vector for weeds such as false brome, shining geranium, stinking bob, blackberries, tree-of heaven, vinca, and bear breeches.

3.3.2 Vegetation: Environmental Consequences

Alternative 1: No Action
Under the no action alternative, the purpose and need of the project would not be met. The project area would remain untreated until the stand reaches minimum age for final harvest. These stands would continue to experience mortality, suppression, and reduced growth from tree to tree competition. Anticipated mortality would not be captured. In uplands and Riparian Reserves, forest conditions would continue to develop a dense closed canopy that reduces the understory vegetative growth and species diversity.

In Calapooya 34, the marketable quality of the blown down wood would reduce in time and the site

would likely be reoccupied with hardwoods making it difficult for the site to reestablish conifer stands.

In Section 35, T.14S.,R01E., hemlock dwarf mistletoe would continue to spread throughout the stand reducing the quality of usable wood. Lightly infected trees have no measurable growth loss, but severely infected trees can lose up to 40% of their potential growth (*Hennon, 2001*). Mortality occurs as a direct result of the infection or attacks by other diseases and insects on the already weakened tree. Dwarf mistletoe infections affect the quality and usable volume of wood.

Special Status Species:
The closing canopy of the forest could ultimately shade out the *Cimicifuga elata*. As the canopy closes in *Cimicifuga* plants may be become smaller and non-flowering.

Access to nearby upland prairies would continue, potentially damaging the prairies and populations of Kincaid's Lupine and associated butterfly species.

Weeds:
Under the No Action Alternative, population of weeds would remain along the roads. False brome, shining geranium and stinking bob could spread into the forest, but it would be at slower rate than under the Action Alternatives.

Alternative 2: Groundbase and Windthrow Removal
The proposed thinning would reduce stand density, decreasing tree to tree competition and accelerating tree growth resulting in larger trees over time. Bigleaf maple and red alder would be removed in the uplands as a commercial product. In Calapooya 35, removing the infected western hemlock trees would reduce the spread of dwarf mistletoe and improve the quality of wood for future harvest. Underplanting with Douglas-fir in the area with heavy infestation would restock the stand with non-susceptible species.

In Calapooya 34, removing some of the merchantable blowdown from the site will create more spaces to reestablish the stand with conifers.

Special Status Species:
The *Cimicifuga* is within the no-touch buffer of a stream. There would be no direct disturbance. Because *Cimicifuga* is a long-lived perennial that thrives best under a high canopy in dappled shade, these plants may benefit from thinning.

To reduce the potential for human disturbance to the upland prairies and its associated species, road 14-2-34 would be blocked during and after project actions.

Weeds:
Although there are several project mitigations dealing with weeds, including treating the project area roadsides for weeds prior to harvesting, these mitigations may not fully get rid of current populations. Therefore, project activities could increase the spread of weeds into treated stands.

Over time, as the canopy closes in, some shade-intolerant weeds could be shaded out. However, there are several species of shade tolerant weeds (False brome, shinning geranium and stinking bob) currently exist along project area roadsides. They are capable of surviving in closed canopy stands. Once established, these species are difficult to eradicate. The blowdown area in Calapooya 34 may be particularly vulnerable as there are few weeds now and logging equipment may spread weeds into this area.

Alternative 3: Cable and No Windthrow Removal
The effects of alternative 3 would be the same as alternative 2 with one exception, the wind thrown trees

in Section 34 T.14S. R.2W., would not be harvested nor planted with conifers. It would be reasonable to assume that this area would convert to a hardwood stand.

3.3.3 Wildlife: Affected Environments

Down Logs:
Down logs are an essential habitat feature for many wildlife species and their prey, including several BLM Special Status Species that could occur in the project area. They often provide breeding or refuge habitat and travel corridors, as well as habitat for prey. They are important to low mobility species with small home ranges (e.g., invertebrates, small mammals, and amphibians). Stand exam data and field review indicate a variety of diameters and decay classes of down logs that are evenly distributed in Riparian Reserves and unevenly distributed in matrix uplands in the project area. The greatest quality and amounts of down logs are present in Riparian Reserves and Matrix uplands in the south half of the Big Fir Spur units.

Stand exam data show that proposed harvest units contain an average of 1165 linear feet/acre (lf./ac). of down logs greater than 8 inches in diameter (see Table 6). Amounts are lower in Calapooya 34 and 35 (873 lf./ac.) and over twice as much in the Big Spur Fir units (1752 lf./ac.). Due to past management and wind-throw events, the Big Fir Spur units contain an high overall amount of large diameter down logs.

Large, moderately decayed down logs (decay class 3-4) are most important to wildlife and represent currently available wildlife habitat. Proposed harvest areas contain an average of 532 lf/ac of down logs $\geq$ 20 inch diameter in decay class 3-4. Amounts are lower in Calapooya 34 and 35 (240-400 lf/ac) and higher in the Big Fir Spur unit (956 lf/ac).

Hard logs in decay class 1-2 (especially small diameter) are less important to wildlife. When large enough, these logs represent potential future wildlife habitat after they decay further. Proposed harvest areas contain an average of 29 lf/ac of decay class 1-2 down logs $\geq$ 20 inch diameter. Calapooya units contain 20-69 lf./ac. of such logs, and none are present in the Big Fir Spur units.

Varying sizes and amounts of stumps and rootwads also exists in the project area. These features only partially fulfill a subset of the total habitat needs for some down log associated species. The quality and amount of this habitat was not quantified by stand exam data, but is generally characterized as low based on field review by the projects wildlife biologist.

Snags:
Snags are an essential habitat feature for snag dependent species and their prey. They are important to primary and secondary cavity nesting birds (songbirds, woodpeckers, owls) and roosting bats.
Stand exam data show that the Calapooya proposed harvest units contain an average of 0.1 snags per acre (0.1/acre in section 34, none in section 35). No snags were detected in the Big Fir Spur unit.

Small Wetlands:
Several small wetlands, both greater and less than one acre exist within the project area. Based on seasonal water depths, local microclimates, and solar exposure, some of these wetlands are suitable breeding and rearing areas for red legged frogs and/or northwestern salamanders. None are large enough to be suitable for western pond turtles or fish.

Federally Listed Butterflies (Threatened and Endangered):
Fender's Blue Butterfly (*Plebejus icariodes*), the Great Copper Butterfly (*Lycaena xanthoides),* and Johnson's Hairstreak butterfly (*Callophrys johnsoni),* habitat exists outside of and near the project area.

Northern Spotted Owl (Threatened and Endangered):
The project area is not in or near a designated Critical Habitat Unit.

Suitable nesting habitat for spotted owls in the area are generally conifer forests greater than 80 years old with at least 70% canopy closure and mature to late-seral characteristics such as dense, multi-story canopies, large down logs and snags, and open understories. Nests are usually located in cavities, fissures, or other deformities of larger trees. Except for scattered individual trees and small patches less than one acre, no nesting habitat exists within the harvest areas. However, 120 acres of nesting habitat exists less than one-quarter of a mile from the proposed Calapooya units, and roughly 80 acres of nesting habitat exists within one-quarter of a mile of the proposed Big Fir Spur units.

Dispersal habitat in the area is generally 40-80 year old stands with at least 40% -60% canopy cover. These stands mostly provide for roosting plus landscape and within-site movements.

Forage habitat is defined as all suitable nesting stands plus dispersal age stands that have some snags or down logs, relatively low brush, lower overall tree density, more complex stand structure, and greater room to move through the mid-understory canopies. About 80% of harvest areas are dispersal habitat. Roughly 50% of dispersal habitat stands are also forage habitat.
Project area stands do not currently provide known forage habitat functioning as requisite support for successful pair reproduction (due to the lack of known sites in the area). However, these stands could fulfill that function in the future if a pair does nest in the general project area.

Currently, there are no known permanent sites in or near (within 1.2 mile) the project area; therefore, no known site Provincial Home Range or nest core habitats would be affected by project actions.

Calapooya 34 and 35 and the general area were surveyed 2-3 times per year in 1988, 1992, and 1995. No spotted owls were detected. Barred owls were detected in 1992 & 1995. Although not a high probability, the general project area vicinity has sufficient habitat to support a pair site. Should owls attempt to nest near the project area (especially in the south half of section 35), the proposed harvest units would likely be used as requisite support for a successful nest.

Big Fir Spur Unit section was surveyed 2 times in 1995 and 3 times in 1997. In 1995 a pair was located in section 35 SW of SW and there were no detections in 1997. Although not a high probability, section 35, with support from other nearby habitats, has sufficient habitat to support an owl pair. Should owls attempt to nest near the project area (especially in the south half of section 35), the proposed harvest unit would likely be used as requisite support for a successful nest.

Table 6 - Coarse Woody Debris Data from Stand Exams

Down Logs

CALAPOOYA & BIG FIR SPUR

DOWN LOGS: Avg Linear Ft./ Ac.

	Diameter Range (inches at large end)			
Decay Class	**8 to 15**	**16 to 19**	**≥ 20**	**Avg Total**
1	33	5	12	50
2	56	25	17	98
3	104	16	133	253
4	63	59	399	521
5	34	91	118	243
Avg Total	**290**	**196**	**679**	**1165**

BIG FIR SPUR Only

DOWN LOGS: Avg Linear Ft./ Ac.

	Diameter Range (inches at large end)			
Decay Class	**8 to 15**	**16 to 19**	**≥ 20**	**Total**
1	0	0	0	0
2	103	74	0	177
3	59	15	15	89
4	103	162	942	1207
5	0	191	88	279
Total	**265**	**442**	**1045**	**1752**

CALAPOOYA 34 & 35 Only

DOWN LOGS: Avg Linear Ft./ Ac.

	Diameter Range (inches at large end)			
Decay Class	**8 to 15**	**16 to 19**	**≥ 20**	**Avg Total**
1	50	8	18	76
2	33	0	26	59
3	126	16	193	335
4	43	8	127	178
5	51	41	133	225
Avg Total	**303**	**73**	**497**	**873**

Snags

CALAPOOYA & BIG FIR SPUR

SNAGS: Avg / Ac. ≥ 15 Ft. Tall

	Diameter Range (dbh)			
Decay Class	**8 to 15**	**16 to 19**	**≥ 20**	**Avg Total**
1	0	0	0	0
2	0	0	0	0
3	0	0	0	0
4	0	0	0.1	0.1
5	0	0	0	0
Avg Total	**0**	**0**	**0.1**	**0.1**

BIG FIR SPUR Only

SNAGS: Avg / Ac. ≥ 15 Ft. Tall

	Diameter Range (dbh)			
Decay Class	**8 to 15**	**16 to 19**	**≥ 20**	**Total**
1	No recorded snags			**0**
2				**0**
3				**0**
4				**0**
5				**0**
Total	**0**	**0**	**0**	**0**

CALAPOOYA 34 & 35 Only

SNAGS: Avg / Ac. ≥ 15 Ft. Tall

	Diameter Range (dbh)			
Decay Class	**8 to 15**	**16 to 19**	**≥ 20**	**Avg Total**
1	0	0	0	0
2	0	0	0	0
3	0	0	0	0
4	0	0	**0.1 (a)**	0.1
5	0	0	0	0
Avg Total	**0**	**0**	**0**	**0**

(a) No snags in section 35 and 0.1/ ac. in sect 34

Coarse woody debris contributing to minimum ROD/RMP specifications of: 240 lf/ac. of down logs and 3.4 snags/ac. with length/height ≥ 20 ft **&** diameter/dbh ≥ 20 in. **&** decay class 1-2.

Shaded cell values are preferred/optimal characteristics used by most wildlife species.

Other Special Status Species (BLM Sensitive):
Other Special Status Species are analyzed below because they are designated as "Sensitive", their habitats are present, and they could reasonably be expected to occur in or near the project area. Pre-project surveys are not required for these species and none were conducted, or are planned before harvest (except for bald eagle nest surveys that would occur in/near the Big Fir Spur proposed harvest unit). Except for known Bald Eagle midwinter roosting areas, existing BLM data do not show known locations of these species in or near the project area.

Bald Eagle (BLM Sensitive):
Suitable nesting habitat for bald eagles in the area is usually located within roughly 1.5 miles of a large aquatic forage resource found in a lake, river, or major tributary. Nest trees are usually large trees with late seral characteristics such as large limbs and large crowns. Stand conditions surrounding nests vary, but are optimal when they have mature-late seral characteristics to provide sufficient protection for nests and nearby perching and roosting areas for adults and juveniles. .

There are no known nests in or near the proposed Calapooya 34 and 35 harvest units, and nesting would not be expected to occur in or near these units due to the lack of proximity to a major aquatic forage resource.

Known and potential mid winter roosting habitat exists near the Calapooya proposed harvest units only. These roosts are subject to disruption or disturbance form noise and line-of-sight actions associated with timber harvest – including road use (roughly 0.25 - 0.5 mile noise and/or line-of-sight). Distances for disruption/disturbance due to some types of quarry actions are up to 1.0 mile. Harvest actions in the western part of Calapooya–section 34 (harvest areas C34-2 and C34-6) and hauling within and away from all Calapooya units, would be seasonally restricted to avoid any disruptions/disturbances to roosting behavior.

There are no known nests in or near the proposed Big Fir Spur harvest units. However, nesting could occur as close as 0.25 mile from the proposed harvest units due to the presence of nearby suitable nesting habitat that is also less than 0.5 mile from a major aquatic forage resource (the Calapooya River). The area has not previously been surveyed for bald eagle nesting behavior.

Northern Goshawk (BLM Sensitive):
This bird prefers to nest in mature to late seral age stands with late seral characteristics such as large trees, dense canopies, down logs and snags, a low brush layer, and a relatively open understory for flying. Most nests located on the Eugene District have been in lower quality mid-seral stands as young as 50 years old that have only some of the preferred late seral characteristics. However, the local significance of such stands, especially their likelihood of facilitating successful reproduction, is unknown. Goshawks forage in nesting habitat as well as younger stands with ample flying room and low brush.

Roughly 50 % of proposed harvest areas (240 ac.) are lower quality suitable nesting habitat. Although characterization of nesting habitat in younger stands in the watershed is difficult and uncertain, project area habitat (except for the south half of the Big Fir Spur units) is nonetheless considered to be low quality due to small tree size, relatively simple tree architecture, and dense-moderately dense dominant/codominant tree spacing, as well as high brush in many areas. The south half of the Big Fir Spur units are of higher quality for nesting than the rest of the project area due to having larger dominant trees and a very high quality and amount of down logs.

Roughly 120 acres of high quality late seral nesting habitat exists $\leq$ 0.25 mile of the proposed Calapooya units, and 80 acres of high quality late seral nesting habitat exists $\leq$ 0.25 mile of proposed Big Fir Spur units. If these areas are used for nesting, foraging would likely occur within project area stands.

Harlequin Duck (BLM Sensitive):
The overall amount and quality of nesting habitat in or near the project area is low. Of the roughly 10 miles of project area streams, terrestrial nesting habitat exists along the one mile of lower quality aquatic habitat in stream 24 in Calapooya section 34. This determination is based on key indicators such as: 3rd to 5th order size, low to moderate gradients with some down logs, boulders, and forested near-stream nesting habitat. The quality of nesting habitat is low due to the minimal amount of stream flying room and a small active channel width on stream 24. This stream would be managed by a no-harvest buffer of 150 feet or more along its entire reach in section 34. Harlequins nest up to 150' away from a stream, although average distances are probably much less. Although individuals show strong fidelity to nesting locations and some acclimation to noise is possible, individuals are generally very intolerant of noise or visual disturbance to nesting from April - mid July.

Fringed Myotis (BLM Sensitive):
This bat roosts in a variety of substrates in coniferous forests, including rock crevices, snags, tall stumps, and the bark or crevices of large live trees. Roosting behavior occurs in different substrates at different times of year and consists of maternity areas, winter hibernacula, and daily rest. Overall the project area contains a very low quality and amount of potential roosting habitat-primarily due to the near complete absence of snags and no rock crevice habitats. The low quality and amount of habitat present is limited to larger stumps, occasional large or remnant live trees, and very low amount of snags (0.1/acre at least 20 inch diameter). The south half of the Big Fir Spur units are higher quality habitat than the rest of the project area due to a greater number of large trees suitable for roosting.

Oregon Slender Salamander (BLM Sensitive):
Key habitat indicators for this species are moist, cool, high canopy cover, coniferous or mixed conifer/hardwood forests with large well decayed ($\geq$ 20 inch diameter, decay class 3-5) conifer down logs and stumps, bark piles at the base of snags, and uncompacted soil.

Overall, the project are contains moderate to high amounts of suitable down log habitat exists. This habitat is present in greatest quality and quantity for this species in much of the Riparian Reserves and in roughly half of the Matrix uplands that are also on north aspect slopes or otherwise have moist microhabitat conditions. The south half of the Big Fir Spur units contain high quality habitat (much higher than the rest of the proposed harvest units) due to high amounts of large, decay class 3-5, conifer down logs. Many of these logs are at least 30-40 inches in diameter. This salamander has a small home range, very low mobility, and is often intolerant of changes to habitat.

3.3.4 Wildlife: Environmental Consequences

Alternative 1: No Action

Snags and Down Logs:
Compared to the action alternative, existing coarse woody debris habitat would not be physically degraded or removed and would not experience changes in its quality or function due to changes in surrounding microhabitats. Over the next few decades, unthinned areas would continue to recruit comparatively greater amounts of small-medium sized coarse wood mostly through mid-seral stand processes such as density induced mortality. However, these stands would not experience accelerated benefits of stands recruiting smaller amounts of larger coarse wood (due to accelerated tree growth).

Small Wetlands:
Effects to small wetlands would be very similar to those described in the Action Alternatives, except that some wetland species may not experience the potential benefits of increased solar exposure due to thinning, such as the red legged frog, whose egg production increases with increase solar exposure.

***Northern Spotted Owl (Threatened*) :**
Compared to the Action Alternatives, dispersal and forage habitat would not be degraded and there would be no chance of any detrimental effects to nesting behavior. However, attainment of improved forage habitat and suitable nesting in thinned Matrix and Riparian Reserve areas would occur at a slower rate due to lack of silvicultural enhancement.

Other Special Status Species (BLM Sensitive)
No short term adverse affects to individuals, reproduction, or their habitats would occur. Riparian associated species, especially harlequin ducks, would not benefit from the Stream Channel Enhancement Actions planned in stream 24 in Calapooya section 34 under the Action Alternatives.

Alternatives 2 and 3: Action Alternatives

Snags and Down Logs:
Project design features would physically retain most existing coarse woody debris in thinning areas. However, some snags and down logs could be felled for safety reasons or damaged by harvest operations (particularly those in decay class 3-5 within yarding corridors or near roads and landings). Depending on localized conditions within thinning areas, direct impacts to coarse wood and overall stand conditions due to changes in surrounding microclimates could adversely affect their function and quality as habitat until stand canopy conditions recover in 5-15 years.

When compared to unthinned stands, thinning harvest causes a change in the size, amount, and rate of coarse woody debris recruitment during the first several decades after treatment. Less newly recruited coarse woody debris would be present in thinned vs. unthinned stands over the next several decades. Compared to unthinned areas, thinned Matrix and Riparian Reserve areas would recruit much smaller amounts and sizes of coarse wood over the next few decades through natural processes seen in mid-seral conifer stands (e.g.,density-induced mortality). Existing moderately decayed large snags and down wood (decay class 2-3, greater than at least 16-20 inch diameter) that are required by many wildlife species would continue to decay and would generally not be replaced by natural stand processes for many more decades. This would result in a shortage of some snag and down log habitats for many decades due to:

1) natural stand processes where there is a reduction in coarse wood recruitment between the end of the high density stem-exclusion phase of mid-seral stands and the early phases of late-seral age stands; and

2) thinning that removes trees that would otherwise be naturally recruited by the stand into down logs (through density-induced mortality caused by high stem densities).

However, larger coarse woody debris would be available sooner in thinned vs. unthinned areas over the next several decades. This would be due to thinned stands experiencing accelerated growth of dominant/codominant trees, and in turn, an accelerated rate when these larger trees would be recruited by the stand into larger coarse woody debris (by natural processes that occur in later seral stands)

Small Wetlands:
All wetlands would be managed with no-harvest buffers of at least 50-100 feet. No-harvest buffers and tree retention rates in thinned areas would adequately maintain terrestrial travel corridors for frogs and salamanders. Harvest actions near wetlands are not expected to adversely affect wetland hydrology, water quality, and individual plant and wildlife species. Nearby thinning actions may improve wetland habitats for some species (e.g, increased solar exposure would usually benefit red legged frog egg development).

***Northern Spotted Owl (Threatened and Endangered*):**

Direct and Short Term Effects:

No nesting habitat would be removed by harvest actions. It is reasonable to assume the few scattered potential nest trees present within harvest units would not be usable for nesting until surrounding canopy conditions recover in 10-20 years. However, all harvest units would be surveyed prior to harvest actions.

Roughly 380 acres (290 Matrix, 90 Riparian Reserve) of dispersal/forage habitat would be degraded to lower quality dispersal-only habitat (with no suitability for forage) due to the removal of some codominant and intermediate trees, reduction in canopy cover from 80-95% to 50-65%, and a potential increase in brush. Depending on the amount of brush and rate of canopy closure increase, stand conditions would minimally begin to recover their function as forage habitat in 10 -15 years (10-20 years in unit BF2). Within the project area, roughly 150 acres of Riparian Reserve dispersal/forage habitat would not be thinned and would continually be available as habitat.

Indirect and Long Term Effects:
Thinning in Matrix and Riparian Reserves would ultimately improve flying room, and accelerate tree growth, and therefore the subsequent rates these stands become higher quality foraging habitat and nesting habitat compared to unthinned areas and the No Action Alternative. However, the future availability of Matrix uplands for nesting or improved forage habitat is uncertain since these lands are subject to regeneration harvest at 80 years of age (within roughly two decades).

ESA Consultation:
Overall, ESA consultation on habitat modification and the potential for noise disruption of nesting, determined that project actions may affect, but are not likely to adversely affect the northern spotted owl.

Cumulative Effects:
The amount, location, and timing of reasonably foreseeable actions that could occur on BLM lands in the watershed that would affect northern spotted owls are not known at this time. Potential effects to habitat in general, as well as effects to individual sites, are not known at this time. Federal actions would likely be thinning harvest of similar habitats and/or regeneration harvest of mature-late seral stands.

Overall, non-federal lands in the watershed mostly contribute some dispersal and forage habitat and negligible amounts of nesting habitat, primarily because most are highly fragmented young-mid seral age stands with very low amounts of coarse wood and late-seral characteristics. On non-federal lands, habitats are generally not expected to improve at all time scales due to typical rotation ages and management actions. Dispersal/forage habitat is usually harvested prior to becoming suitable nesting habitat.

***Bald Eagle (BLM Sensitive*)**:
No suitable nesting or mid winter roosting habitat would be modified by project actions.
Nesting could occur near the Big Fir Spur unit. Nests are subject to disruption or disturbance from noise and line-of-sight actions associated with timber harvest – including road use (roughly 0.25 - 0.5 mile noise and/or line-of-sight). Distances for disruption/disturbance due to some types of quarry actions are up to 1.0 mile. The project area and vicinity would be surveyed prior to actions that could affect nesting. If a nest is located, appropriate seasonal restrictions would be applied to ensure project actions would not preclude or otherwise disturb nesting behavior. Overall, the chance of adverse affects to eagle nesting due to project actions would be very low.

Midwinter roosting occurs near the Calapooya units. Project mitigations would ensure no negative effects to midwinter roosting behavior.

***Northern Goshawk (BLM Sensitive*) :**
Roughly 70 % of the existing low quality nesting habitat for goshawks (est. 170 acres) would be degraded

in the short term by thinning due to a reduction of canopy closures, and a potential for an increase in brush. However, almost all retained dominant and codominant trees would remain structurally suitable for nesting after harvest and could be used for nesting as soon as surrounding stand conditions sufficiently recover in 5-15 years post-harvest (10-20 years in unit BF2). Future nest suitability would depend on individual tree characteristics, the amount of brush, and rate of stand canopy closure increase. Thinning would improve the short and long term quality of nesting and foraging habitat by removing densely stocked understory trees and accelerating growth of dominant/codominant trees.

Pre-project nest surveys would not be conducted; therefore, when project actions occur during the nesting season (April to August), they would have a potential to preclude or disrupt nesting behavior that could occur in or near harvest areas. However, the chance of nesting in the project area is low due to the low quality of habitat, and the overall chance of nesting near the project area is generally assumed to be low based on the small amounts of nests found on the District over the last 10 years.

Harlequin Duck (BLM Sensitive):
The one mile of stream habitat present in the project area would have a no-harvest buffer of at least 150 feet which would result in no effect to aquatic or terrestrial habitat where individuals would likely nest. Noise or line-of-sight disturbance to nesting (March-July) is possible but very unlikely due to the low amount of habitat in the project area, and no harvest buffer widths that would greatly mitigate any potential noise and line-of-sight disturbances. Thinning in various portions of the Riparian Reserves would accelerate the rate large live trees would be available as large down wood in streams or nearby terrestrial habitats (as compared to unthinned areas and the No Action Alternative).

Stream Channel Enhancement Actions would add instream large woody debris to Stream 24. This would immediate improve habitat by improving habitat for prey items as well as adding nesting and loafing structure.

Fringed Myotis (BLM Sensitive):
Overall, the chance of effects to this species is low to the low amount of habitat in the project area. In the short term, retention of dominant live trees would physically reserve the low amount of project area habitat for fringed myotis in areas subject to thinning harvest. However, direct detrimental impacts to the quality of roosting habitats could occur due to changes in surrounding microclimate condition (e.g., undesirably cooler, warmer, or less stable temperatures inside roosts). Some impacts to larger live trees may be beneficial (e.g., those that become favorably warmer due to increased solar exposure). Many of these impacts to habitat would again be reduced, or changed in 5-15 (10-20 years in unit BF2) years as stand canopy closure increases.

Project actions could disturb winter hibernacula or maternity behavior from September through May and daily roosting from spring through fall. This could cause individuals to be displaced from the area. Nearby forage habitat in standing ponds, and streams would not be adversely affected by project actions. Thinning would accelerate the rate that large live trees or subsequent large snags would be available as habitat (as compared to the No Action Alternative).

Oregon Slender Salamander (BLM Sensitive):
In the short term, retention of existing downed logs and snags would reserve most habitats for the species. However depending on the physical damage to some down logs by logging, and changes to local moisture conditions, the quality and function of some down log habitat could be degraded for at least 5-15 years until stand canopy conditions recover. Individuals could be displaced and local numbers reduced, during the first 1-15 years after harvest. Recolonization of thinned areas from nearby untreated stands is possible but could take several years/decades. Nearby untreated uplands and roughly 110 acres of untreated Riparian Reserves should continue to provide habitat after harvest, thereby providing local ‘refugia’ for

the species.

Overall, the project area currently contains moderate to high amounts of large, moderately decayed down wood that is currently optimal habitat for the species (See Key Habitats Section discussion on coarse woody debris recruitment). The overall decay rate –and subsequent loss of down log habitat- would be less in the south half of the Big Fir Spur units due to the large size of many of the down logs (many are at least 30-40 inches in diameter).

Down log creation in Calapooya units would help ameliorate the loss of future recruitment of new down logs. These logs would become habitat once they sufficiently decay (est. 1-2 decades).

Cumulative Effects to all "OTHER SPECIAL STATUS SPECIES:"
The amount, location, and timing of reasonably foreseeable actions that could occur on BLM lands in the watershed are not known at this time. Actions would likely be thinning harvest of similar habitats and/or regeneration harvest of mature-late seral stands. For most species, cumulative landscape level effects are not known due to lack of specific information on individuals or local habitats (e.g., down logs and snags) as well as specific project locations. Overall, non-federal lands in the watershed mostly contribute some short term low quality habitat for goshawks and harlequin ducks, but little high quality or ongoing habitat for these or other non-T&E special status species primarily because most are young-mid seral age stands with very low amounts of coarse wood and late-seral characteristics. These non-federal lands are often sinks, or barriers to landscape movements for salamanders. Habitats are generally not expected to improve at all time scales on non-federal lands due to typical rotation ages and management actions.

3.3.5 Fish and Hydrology: Affected Environment

Hydrology:
Most of the project area is in the Calapooia River 5th Field Watershed east of Brownsville, Oregon. This watershed is located in the Upper Willamette 4th Field Watershed.

Calapooya 34 and 35 lies in the headwaters of the Courtney Creek drainage, which is a large tributary of the Calapooia River. The Big Fir Spur project area is located in the headwaters of Sweet Home Creek and an unnamed tributary, both flowing into the Calapooia River. A small portion (~10 acres) of the Big Fir Spur unit lies in the Wiley Creek 5th field watershed.

Precipitation in this region is between 45 to 60 inches annually and the majority occurs in the form of rainfall between October and April. The project area ranges in elevation from about 960 to 2500 feet, with most acres in the rain dominated precipitation zone. The Calapooya units are in the rain dominated area. Areas most susceptible to rain-on-snow events are those above about 2100 feet in elevation and most of the Big Fir Spur unit in Section 35 is within the transient snow zone.

About 60 tributary streams exist within or adjacent to the project area. Most of these are perennial and either first or second order streams. Some of those streams are not connected by surface flow to the rest of the system. Thirteen wetlands, and nineteen springs have also been identified.

Water Quality:
The Oregon Department of Environmental Quality (ODEQ) developed Total Maximum Daily Loads (TMDLs) for temperature, bacteria, dissolved oxygen and turbidity for the Upper Willamette Subbasin in September 2006. Temperature and mercury (via sedimentation) may have a causal link to forest management and therefore those parameters have been addressed in the *Eugene BLM Water Quality Restoration Plan* approved by ODEQ in July 2008. That plan outlines a comprehensive strategy for implementing, monitoring, and evaluating management to address water quality impairment on BLM lands

in the Willamette Basin.

The Calapooia River (downstream from Big Fir Spur Unit) is listed on the ODEQ 303(d) List of Impaired Waters for exceeding State of Oregon standards for a host of pollutants including chemicals, metals, e-coli and fecal coliform, and elevated water temperatures. Courtney Creek (downstream from Calapooya II Units) is on the 303(d) list for pH, phosphate phosphorus, and elevated water temperatures.

BLM has not collected water quality data in this watershed. In conjunction with efforts to assess water temperature conditions for the Water Quality Restoration Plan, shade measurements were taken at two sites near the project area. The first site was on a large stream (Stream #1) in Calapooya Section 35 and effective shade was measured in August 2007 to be approximately 90%. The other site was down-gradient from Big Fir Spur on BLM land not included within the proposed harvest area. Effective shade on that stream reach was approximately 83% in August 2007. The target shade for those areas is approximately 97% based on effective shade curves for this area.

Roads and skid roads from past timber harvesting have impacted the stream network in many places throughout the project area. Impacts from past logging activities range from old log culvert stream crossings to skid roads constructed on top of stream channels or on soils susceptible to compaction. Erosion and sedimentation from these old roads has delivered fine sediment to the channels, undercut stream banks, and in some cases buried channels with road related debris. A few of these old roads now carry water during the winter storm events and as such, have extended the natural stream system. In the Big Fir Spur unit, several wetlands developed in areas with poor drainage apparently as a result of past ground disturbing activities.

Old roads have also been utilized as recreation trails. These trails are not designated for approved use. These trails tend to be eroded and are a chronic source of sediment to nearby streams, or to the ditchline of roads that can route directly to surface waters. Decommissioning these trails has not been included into the proposed actions for this project.

Certain stream crossings and relief culverts on existing roads in this project area are not functioning properly due to rust, mechanical damage, being undersized, or otherwise having a risk of failure. These stream crossing culverts are sources of chronic sediment input to streams and a risk of mass wasting in the future. Also refer to the Log Haul Route discussion below for further discussion of road conditions.

Stream-side slope stability:
The upper reaches of Stream 18 and 24 have unstable stream banks due to undercutting and erosion from past logging activities.

Fish Bearing Habitat:
Within the Calapooya project area, four stream reaches were determined to be fish bearing, or having suitable habitat for the spawning and rearing of salmonids (trout) and other fish species. In section 34, cutthroat trout were documented in the lower portion of Stream 24 up to the confluence of Stream 25. No fish were found in Stream 18; however, based on stream gradient and habitat conditions this reach is considered accessible and suitable for trout species. Steep channel gradient just below the 14-2-16 road restricts further upstream migration. Similar conditions exist in Stream 1 and 7 (section 35), where no fish were detected but based on habitat conditions and the presence of fish just outside of the project area, the lower 700 feet of each stream is considered suitable for trout and other fish species. Steep channel gradient and waterfalls restrict further upstream migration. All streams in the Big Fir Spur unit are non-fish bearing due to steep downstream channel gradients. The nearest fish bearing habitat is approximately 0.25 miles from the project area (Sweet Home Creek).

ESA Fish Species:
Both Upper Willamette Spring Chinook and Upper Willamette Winter Steelhead are listed as Threatened under the Endangered Species Act (ESA) in the Calapooia Watershed. Known spawning and rearing habitat occurs in the mainstem Calapooia River, approximately 10 miles from the Calapooya II units and 1.5 miles from the Big Fur Spur units.

Aquatic habitat - Calapooya 34 and 35:
Within and adjacent to the project area, these headwater reaches can be characterized as moderate to highly confined channels (hillslope, terrace constrained) in a narrow valley floor. Channel gradients vary from moderate (5%-20%) to steep (<20%) with numerous moderate to high step-over-boulder/log features and waterfalls. Aquatic habitat is predominately cascade-plunge pool-riffle sequence. Pool depths tend to be shallow, range from 1-2'. Boulder and cobble substrate dominate the channel with minor amounts of gravel, silt, and sand. The volume of in-channel large woody debris is low to moderate, mostly in the later decay classes. Generally, stream channels and banks are stable. Streamside vegetation is moderately dense thus providing adequate shade, cover, food, and stability to the stream system. No human caused barriers to fish were documented within this project area.

Aquatic habitat - Big Fir Spur:
High-gradient and steep step-over boulder and log features downstream of the project area restrict movement of fish into project area. However, stream channels within the project area tend be low gradient. Channel beds are dominated by silt/sand sized materials (minor amount of gravel and cobble), and characterized as a series of riffles and irregular spaced scour pools. Instream large wood is very high. Large remnant down wood exists throughout most of the project area. Streamside vegetation is providing adequate shading and bank stability.

Log Haul Route (Road-Related Sediment Delivery Analysis):
Log haul would occur over gravel and paved roads controlled by BLM and private industry. The majority of log haul in the Calapooya project area would occur on Road 14-2-16 which is mostly a paved road system. The Eugene BLM has recently renovated this road by replacing a large number of stream crossing culverts, thus reducing the potential for failure and mass wasting. However, additional stream crossings and relief culverts have been identified for replacement within the project area. Approximately 0.75 mile of the 14-2-35 road would be used. This is a paved road with no stream crossings and no sediment delivery issue to the stream network. The 14-2-35.1 is mostly unimproved and is currently blocked to vehicle access. There are seven stream crossings along this road, of which, the majority are old log culvert sites that have failed over time. Erosion is still occurring at these sites thus creating some channel and bank instability and downstream sedimentation. Approximately 0.4 mile of this road would be used for log haul and would require extensive reconstruction.

For the Big Fir Spur units, the 15-1E-2 and 14-1E-36 roads would be used for haul log. Both are gravel surfaced roads. The 15-1E-2 road has limited hydrologic connection and generally adequate relief drainage. The 14-1E-36 has a higher connection to the stream network, and thus a higher potential for road sediment delivery. The road segment within and near the project area is in need of relief culverts or road lead-offs to reduce road sediment delivery. Two stream crossings culverts were identified as high priority for replacement.

Fish and Hydrology: Environmental Consequences

<u>Alternative 1: No Action</u>

Peak Flow:
In the short term, peak flows would be maintained on BLM lands in the watershed since no harvest or road

work would occur. In the long term, the timing and magnitude of stream flows could be impacted because improperly draining roads or trails may directly route surface runoff to the stream system. The extent of such an impact is unknown.

Stream Temperature:
No short term changes to stream temperature would be expected, since existing shade in the riparian areas would remain unaltered from current conditions. In the long term, riparian vegetation would continue to grow, providing increased shade to protect stream temperatures.

Sedimentation:
Turbidity in streams adjacent to the project area could increase because road and trail repairs would not take place. Water quality and impacts to fish bearing habitat would continue to be impacted by road and trail related sedimentation under this alternative. Deteriorating undersized stream crossing culverts could plug, blocking stream flow and the resulting road failure(s) could cause channel scouring downslope from the road. Road related sedimentation could escalate for three reasons: 1) no stream crossing culverts (log or corrugated metal) would be replaced, 2) lead-off ditches or relief culverts would not be properly maintained (or new ones installed), and 3) no additional aggregate would be placed on the local access roads or haul routes. As a result, direct sediment delivery to streams via the ditch line from those roads would continue. Because of the lack of aggregate, any future road maintenance would directly accelerate sediment delivery to streams.

Road related sedimentation could escalate because failing stream crossings in all units would not be replaced, and the undesignated trails that have been identified with stream impacts would not be decommissioned. Conditions on these unauthorized trails could worsen due to lack of any maintenance or closure, resulting in more sediment delivery to the nearby streams. The opportunity to decommission or upgrade portions of Road 14-2-35.1 would be postponed until a later date, and seven stream crossings on that road could further deteriorate under extreme storm conditions due to lack of appropriate surface water drainage.

Riparian and Instream Large Woody Debris:
This alternative would have no immediate affect on the level or recruitment of instream large woody debris. The recruitment of large wood to the stream channel would continue by natural processes. However, due to the uniform nature of the riparian stand, the development of large trees and subsequent large woody recruitment to the stream channel would occur at a much slower rate than Alternative 2.

The Aquatic Habitat Restoration proposal would not occur under this alternative. Current levels of in-stream large wood in Stream 24 (fish bearing) would remain at low to moderate levels until modified by natural processes. The lack of habitat complexity, rearing habitat and spawning grounds would continue to be limiting factors for the production of salmonids.

Cumulative Effects:
Cumulative effects from a variety of sources could increase fine sediment into the stream channels and negatively effect downstream fish habitat. Road decommissioning, road maintenance, and the closure of undesignated OHV trails would either not take place, or be postponed until a later date. Water quality degradation and impacts to fish bearing habitat may increase as several road and/or undesignated OHV trail-stream crossings further deteriorate due to the lack of maintenance. Without additional aggregate surfacing and relief drainage, future road conditions could accelerate sediment delivery and surface runoff to streams. Undesignated OHV trails would continue to erode, providing direct delivery of sediment to adjacent streams. The unauthorized trail system could also potentially expand because access would not be restricted.

The effective shade would be maintained along streams on BLM land, but timber harvesting on private lands may be conducted using different standards, possibly reducing the effective shade zone in those areas and increasing solar radiation to streams flowing onto BLM lands. Stream channel complexity would improve at a slower rate, therefore the quality of fish habitat, overall biotic production of the system, and the reduction of water temperature due to deeper pools and reduced velocities would take longer to achieve. No improvement to stream temperatures would be expected either, since the addition of large wood to streams would not occur. As a result, deeper pools and time-accelerated channel complexity would be forgone.

As compared to the Action Alternatives, this alternative is expected to negatively impact water quality and downstream fish bearing habitat over the long term on BLM lands within the Calapooia watershed. The potential to improve aquatic habitat conditions through road decommissioning, undesignated OHV trail closure, and replacement of high risk road-stream crossings, road drainage improvements, and increased channel complexity through placement of instream large wood would not occur.

Alternatives 2 and 3: Action Alternatives

Peak Flow:

Commercial thinning and road work are not expected to measurably impact current peak flows because most of the harvest area is in the rain dominated zone, protective no-harvest buffers would be retained adjacent to all streams, and road improvements would reduce runoff to streams. It is unknown to what extent undesignated and unmapped OHV trails may impact the timing and magnitude of stream flows. It is also unknown when the culverts that are not replaced under these alternatives will be addressed in the future. Therefore in the long term, there could be increased runoff to streams via eroded road ditches at culvert locations that failed because they were not replaced under these actions.

Stream Temperature:

Treatment in the Riparian Reserve is not expected to impact water temperature, thereby protecting habitat conditions for aquatic and riparian-dependent species. No-harvest buffers would be left intact and would protect existing effective shade. These buffers range from 25 feet for seeps and springs and Stream #9 in Unit C35-3, 75 feet for small 1st and 2nd order non-fish bearing streams, and 100-175 feet for fish bearing or larger stream channels. The primary shade zone along all streams would be maintained by these no-harvest buffers.

Thinning within the secondary shade zone would maintain at least fifty percent canopy closure, except along a small portion of the south side of Stream 4 in Big Fir Spur. Although thinning in the secondary shade zone may slightly increase direct solar radiation penetrating into the primary shade zone, the primary shade zone would provide sufficient shading to maintain stream temperatures. The potential cable corridors across Stream 9 in Unit C35-3 are not expected to impact downstream temperature because this stream is not connected by surface flow to the rest of the system. This stream was created in part, by soil compaction from past ground-based harvesting. Stream crossing culvert replacements may result in the loss of some overstory vegetation, but not to measurably affect stream temperature. The addition of large wood to Stream 24 would eventually result in increased pool habitat (backwater and scour pools) and the depth of pools, thus increasing thermal refuges for salmonids during summer low flows.

Sedimentation

Treated riparian reserves would have no-harvest buffers widths of 25 to175 feet. These buffers would provide protection to over-steepened and/or unstable streambanks and headwalls, and filter out potential sediment transported from cable and ground-based yarding processes; thus, minimizing sediment-related impacts to nearby streams and fish bearing habitat. Cable yarding landings are generally located on ridgetop topography and outside of the stream influence zone, providing added protection to aquatic and riparian habitat features. To minimize adverse effects to stream habitat, site specific mitigation measures

would be implemented for landings located in Riparian Reserves (e.g. relief culvert installation to reduce direct sediment delivery). The implementation of project design features would minimize most potential sediment related effects on water quality and aquatic habitat from harvest activities.

Short-term increases in sediment could be caused by removing and/or replacing existing culverts, utilizing logging corridors across Stream 9 in Unit C35-3, decommissioning four stream crossings on Road 14-2-35.1, and renovating roads. The proposed temporary road construction is not expected to result in detectable road related sedimentation nor impacts to fish-bearing habitat due to predominately ridgetop locations or in areas with little or no direct connection to the stream network. The main sediment impact from road improvement would be the replacement of stream crossing culverts. Implementation of project design features and on-site design of the crossing sites would minimize most potential impacts to streams and downstream fish bearing habitat.

Long-term decreases in sediment delivery would result from upgrading permanent roads by replacing culverts, adding cross drains, adding aggregate, and also decommissioning one road identified for closure. Typically, fine sediments disturbed by construction activities are flushed out by seasonal fall rains, and some erosion occurs until disturbed soils at the stream crossing inlets/outlets are stabilized by vegetation, mulch, or rip-rap. Replacement culverts sized to accommodate 100-year storm events would reduce the risk of catastrophic failure during major flood events and impacts to downstream spawning and rearing trout habitat.

Decommissioning a portion of the 14-2-35.1 road and old spur roads off the 14-2-34 would eliminate artificial barriers to sediment transport and reduce the potential for future road prism failure. Sediment, bedload materials, and woody debris stored above the stream crossings on these roads may mobilize once the crossings are removed. The natural sediment regime would be restored. Tilling (where feasible) would help restore water infiltration to the soil and reduce the potential of surface runoff reaching nearby streams. For these reasons, road decommissioning would have long-term beneficial effects to riparian areas and downstream fish habitat despite the short-term sedimentation impacts from stream crossing restoration. Since undesignated OHV trails would not be closed under these alternatives, continued erosion and sediment delivery to streams is anticipated from those routes. The extent of those impacts is unknown.

Log Haul:
Within the Calapooya II project area, the majority of the log hauling would occur on paved road surfacing (west portion of 14-2-16 and 14-2-35), which is not expected to result in road-related sediment delivery to the stream network. However, on gravel surfaced roads (east portion 14-2-16 and 14-2-35.1) increased road use from log hauling and related activities could result in short-term increases in sedimentation and associated turbidity to streams, especially during the wet period of the year. Road improvements and maintenance, such as the replacement and installation of relief and stream culverts, adding and maintaining aggregate on haul routes, and maintaining well vegetated road ditchlines should minimize impacts to the project area streams. Potential fine sediment input to project area streams via log haul operations is expected to be retained, at least temporarily, in these headwater streams thus having limited impact to downstream fish bearing habitat.

Log haul in the Big Fir Spur unit would occur on gravel surfaced roads. Similar road improvements and maintenance standards would occur within this project area as in the Calapooya project area. The addition of new stream crossings, relief culverts, and road surface aggregate, especially within and near proposed stream crossings, would greatly reduce road-related sedimentation to project area streams.

Instream Large Wood:
The action alternatives would treat the outer portions of the Riparian Reserves. Thinning is expected to

speed the development of large-diameter trees thus resulting in a long-term increase in large woody debris (LWD) recruitment levels in streams and riparian areas within both project areas.

The immediate contribution of LWD (~35 felled trees) would influence stream channel flow and create and maintain spawning and rearing habitat for resident trout species. This proposal would provide refugia habitat (cover), influence the size and location of pools, the formation of deeper pools, creation of backwater and off-channel habitat, and the deposition and sorting of gravels thereby providing suitable spawning habitat.

Cumulative Effects:
Implementation of Alternatives 2 or 3 would be expected to reduce sediment delivery and improve aquatic habitat within the 5th field watersheds. These alternatives, combined with on-going and future road renovation on BLM and privately owned lands, would result in a long-term reduction of road-related sediment and surface water runoff delivery to streams and fish bearing habitat. No measurable impacts to stream flows are anticipated from harvesting, or road related actions.

In the Big Fir Spur unit, harvesting activities on soils with high clay content and seasonally high moisture could result in the creation of new wetlands resulting from compaction from ground-based harvesting, or new stream segments from gouging during cable harvesting operations. The spatial extent of such impacts is unpredictable.

Protective streamside buffers on BLM land and the utilization of standard best management practices (BMP's) would maintain or reduce existing sediment rates to streams. The addition of large wood to the system would help regulate the sediment regime and add to stream habitat complexity. A higher diversity of riffle and pool habitat is expected to develop over time, thus influencing the physical and biological characteristics of the stream system and creating productive habitats for salmonids. Large woody debris entering the stream system from BLM lands (either naturally or stream channel enhancement) would be distributed downstream over time by natural processes, thereby providing benefits beyond the project area.

Replacement of deteriorated and/or undersized stream crossing and relief culverts and decommissioning roads with potential impacts to impact aquatic life and water quality would greatly reduce the risk of mass wasting and the chronic erosion and sedimentation thus providing benefits to the overall health of the aquatic ecosystem within the watershed. In the long term, culverts not replaced under these action alternatives may further deteriorate and route sediment directly into nearby streams.

Maintaining primary shade zones along streams in these 5th Field Watersheds would protect water temperatures on BLM land. Such standards are not consistently used on private lands therefore, sediment and temperature increases elsewhere in the watershed could possibly occur.

3.3.6 Fuels: Affected Environment

The current condition of the dead fuels on Big Fir Spur is typical of most stands at that stage of development except for an abundance of large partially decays logs. Fine fuels (<3" diameter) are relatively light and within the natural range of variability. Estimation of current fine fuel loading is approximately 7 tons/acre. The large partially decayed logs do not represent a fire hazard as they would not contribute to higher fire intensity or rates of spread. The large material would, if a fire was to occur, contribute to higher fire severity and very high levels of smoke emissions under typical summertime conditions. The high severity would occur due to long duration smoldering of the material which would result in high soil temperatures. The high emissions would occur because long duration smoldering is very inefficient and produces large amount of smoke emissions as opposed to the burning of fines fuels which is short term and largely flaming consumption which is more efficient (cleaner burning). The other

effect that the large material would have if a fire was to occur within the project area would be a high resistance to control. This is due to the slower fireline construction rates that could be achieved by fire suppression resources. A fire may grow to a larger size than it might otherwise due to slower fireline construction rates in areas of high concentrations of partially decayed logs.

The current condition of the dead fuels on Calapooya 34 and 35 is typical of most stands at the current stage of development. Fine fuels (<3" diameter) are relatively light and within the natural range of variability. Estimation of current fine fuel loading is approximately 6 tons/acre. Some large partially decayed logs are present but do not represent a fire hazard as they would not contribute to higher fire intensity or rates of spread. The large material would, if a fire was to occur, contribute to higher fire severity and very high levels of smoke emissions under typical summertime conditions. The high severity would occur due to long duration smoldering of the material which would result in high soil temperatures. The high emissions would occur because long duration smoldering is very inefficient and produces large amount of smoke emissions as opposed to the burning of fines fuels which is short term and largely flaming consumption which is more efficient (cleaner burning). There is not enough large material to have a significant effect on the resistance to control if a fire was to occur within the project area. Snags are not common within either stand and would not have a significant effect on fire spread or fire suppression.

3.3.7 Fuels: Environmental Consequences

Alternative 1: No Action

No immediate impact on fuels. Within a relatively short period the stand will see an increasing amount of mortality as the stand self thins. This will eventually result in moving from a light timber litter (Fuel Model 8) to a heavy timber litter (Fuel Model 10) with higher potential for intense fire behavior that is difficult to control, crown fire or a stand replacing fire event than if the stand was thinned. If no action occurs then a hazard reduction treatment may become necessary at a later date.

Alternatives 2 and 3: Action Alternatives

This alternative would result in a fuel loading of approximately 50 tons/acre. The result would be relatively light slash and would be classified as light logging slash (Fuel Model 11). This fuel bed could produce 3 to 5 foot flame lengths under severe fire weather conditions and a 5 mph mid flame wind speed. Fires of this intensity are at the upper limit of hand crews and engines ability to effectively suppress. In addition if a fire were to occur while the slash is in a "red slash" condition, where the needles have not dropped from the slash and are cured, it would exhibit fire behavior more characteristic of a fuel model 12 (moderate slash).

A "red slash" condition could yield flame lengths of 6 to 7 feet under severe fire weather conditions. This would be beyond the capability of hand crews and engines to effectively direct attack and suppress. Fire line construction would be difficult due to the large number of large diameter Decay class 4 logs scattered throughout the unit. Fuels would tend to be heavier in the direction of the yarding and small landing piles of unmerchantable material are expected approximately every 150' along roads. These piles would act as point sources for high fire intensities and long range spotting in the event of a fire.

3.3.8 UNAFFECTED RESOURCES

The following are either not present or would not be affected by any of the alternatives: Spring chinook critical habitat, Areas of Critical Environmental Concern, prime or unique farm lands, solid or hazardous wastes, Wild and Scenic Rivers, or Wilderness.

3.3.9 ENVIRONMENTAL JUSTICE

To comply with Executive Order 12898 of February 11, 1994, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, the Bureau of Land Management, Eugene District, would ensure that the public, including minority and low income, have adequate access to public information relating to human health or environmental planning, regulations, and enforcement as required by law. The District has not identified any environmental effects, including human health, economic and social effects of Federal actions, including effects on minority populations, low-income populations, and Native American tribes, in this analysis.

3.3.10 CULTURAL RESOURCES

Surveys were conducted 2008. No cultural resource sites were found.

4.0 CONSULTATION

Upper Willamette Spring Chinook (Threatened)/Upper Willamette Winter Steelhead - ESA Affects Determination

Based on the extended distance to the ESA listed fish habitat and project design features, the proposed action alternatives would have no effect to ESA listed fish species or critical habitat in the Calapooia Watershed; therefore, consultation with the National Marine Fisheries Service is not required

Essential Fish Habitat

The Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA) requires Federal agencies to consult with the Secretary of Commerce regarding any action or proposed action authorized, funded, or undertaken by the agency that may adversely affect Essential Fish Habitat (EFH) under the Act. The action alternatives, as described and analyzed in this environmental assessment (EA) would have no adverse effect on waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity.

5.0 LIST OF PREPARERS

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Mike Blow	Wildlife Biologist	Wildlife
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Mike Sabin	Engineer	Engineering
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Christie Hardenbrook	Environmental Specialist	Team Lead/NEPA

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Appendix A: Maps